AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
	1 | 15

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0001	01-Nov-2022		

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
CONTRACTING DIV US ARMY CORPS OF ENGINEERS, TULSA DISTRICT 2488 E. 81ST STREET TULSA OK 74137-4290	W912BV	See Item 6	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
	X	9A. AMENDMENT OF SOLICITATION NO. W912BV23B0001
	X	9B. DATED (SEE ITEM 11) 21-Sep-2022
		10A. MOD. OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [X] is extended, [ ] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Amendment 0001 hereby makes changes section 00 22 11, adds attachment A and attachment b, updates site visit information in FAR clause 52.236-27, updates FAR clause 52.211-10, and updates sections 01 91 00 and 33 52 43.

All other terms and conditions remain unchanged.

Contract Specialist: Lindsey.M.Byfield@usace.army.mil.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SECTION 00 11 00 - SF 1442 AND CLIN SCHEDULE

SUMMARY OF CHANGES

SECTION 00 11 00 - SF 1442 AND CLIN SCHEDULE

The required response date/time has changed from 25-Oct-2022 02:00 PM to 15-Nov-2022 02:00 PM.
The performance period code has changed from Mandatory to Negotiable.
The contractor period of performance end 270 has been deleted.

SECTION 00 21 00 - INSTRUCTIONS, CONDITIONS & NOTICES TO OFFERORS

The following have been modified:

INSTRUCTIONS

INSTRUCTIONS FOR PROCUREMENT,
CONDITIONS,
AND
NOTICES TO OFFERORS

1. GENERAL DESCRIPTION OF WORK

This solicitation is utilizing the Two-Step Sealed Bidding procurement method as described in FAR Part 14.5 to award a firm fixed-price contract for the project titled "Repair B1956 and Replace HVAC" at Sheppard AFB, TX. The general scope of the design-bid-build project requires the contractor to repair, replace and improve building systems of a 67,000 square foot facility, including fire suppression, plumbing, HVAC and electrical, and repair damage to interior elements, surfaces, and finishes. Maintain the existing HVAC ductwork and replace only wetted insulation. Add HVAC fault detection and diagnostics when replacing controls to include added temperature monitoring. Replace all wet piping and restore to a comparable system with freeze protection. Make only minor repairs to select features of the fire alarm and mass notification system as directed. Demolish 14 existing jet fuel pumps located in inside various classrooms and install a new fuel pump by existing outside fuel tank.

This solicitation is for Step One, which is a request for technical proposals only. The technical drawings and specifications for Step One are approximately 80% complete and not considered final or for construction.

Step One submissions will be reviewed for acceptability only. In Step One, a proposal must be rated as acceptable for all evaluation factors in order to receive an overall "acceptable" rating and to be able participate in the Step Two bid.

In Step Two, only offerors who submitted acceptable technical proposals in Step One will be allowed to submit bids. The 100% final technical drawings, final bid schedule and other final bidding information will be provided to all technically acceptable firms during Step Two via a solicitation amendment.

2. GOVERNMENT SECURITY REQUIREMENTS

The Contractor shall submit all volumes of its proposal electronically via Procurement Integrated Enterprise Environment (PIEE) Solicitation Module (https://piee.eb.mil).

USACE Tulsa District Point of Contact is Ms. Lindsey Byfield:
Phone: 918-669-7070
Email: Lindsey.M.Byfield@usace.army.mil

3. COPIES OF SOLICITATION DOCUMENTS AND AMENDMENTS

Copies of the solicitation and any amendments will be posted electronically on SAM.gov, Contract Opportunities via the Procurement Integrated Enterprise Environment (PIEE) suite at https://piee.eb.mil/.

Solicitation Number: W912BV23B0001

It shall be the offeror's responsibility to check the websites for any amendments. The offeror shall submit in the proposal all requested information specified in this solicitation. The opening of Step Two bids will follow the procedures set forth in FAR 14.402.

Any information given to an offeror which impacts the solicitation and/or offer will be given in the form of a written amendment to the solicitation.

4. OFFEROR'S QUESTIONS AND COMMENTS

All contractual matters, questions and or comments relative to these documents should be submitted via Bidder Inquiry in ProjNet at http://www.projnet.org/projnet/binKornHome/index.cfm?strKornCob=HomePagePublic no later than 10 calendar days prior to the proposal due date, in order that they may be given consideration or actions taken prior to receipt of offers.

The bidder inquiry key for this project is: **P44F24-CJRRHF**.

Instructions for registering in the ProjNet Bidder Inquiry system are available on the above website.

5. SMALL BUSINESS SIZE STANDARD/NAICS CODE

The NAICS Code selected for this project is 236220, Commercial and Institutional Building Construction, and the size standard is $39,500,000.00. Also see FAR 52.204-8.2

6. PROPOSAL/BID EXPENSES AND PRE-CONTRACT COSTS

This invitation for bid (IFB) does not commit the Government to pay, as a direct charge, any costs incurred in the preparation and submission of a proposal.

7. SITE VISIT

The Government intends to hold a site visit during Step One of the solicitation. The date, location, and time will be announced by amendment to the solicitation. All interested offerors are highly encouraged to attend in person.

The site visit information will be provided by amendment.

All interested offerors are urged to attend. During this conference, the requirements set forth in the solicitation will be reviewed and discussed, with part of the conference to include a question-and-answer period.

8. ACCURACY IN PROPOSALS/BIDS

Proposals must set forth full, accurate, and complete information as required by this IFB, (including attachments). The penalty for making false statements is prescribed in 18 U.S.C. 1001.

9. PROPOSAL/BID SUBMITTAL

9.1 The submittal method for proposals is electronically through the Solicitation Module of the Procurement Integrated Enterprise Environment (PIEE) suite at https://piee.eb.mil/ using the applicable solicitation number.

Proposals submitted by email, mail or hand-carried will not be evaluated. Proposals sent through proprietary or third-party File Transfer Protocol (FTP) sites or DoD SAFE will not be retrieved. It is the responsibility of the offeror to confirm receipt of proposals.

9.2 Proposals/bids will be received until the date and time and specified in this Invitation for Bid.

9.3 The packaging shall be marked Solicitation Number: W912BV23B0001.

9.4 Submitted technical proposals in response to this solicitation shall not include prices or pricing information. Bid bonds are not required to be submitted with the Step One technical proposal. Bid bonds will be required to be submitted with the Step Two bid submission.

10. PROPOSALS/BID DUE DATES

The Step One request for technical proposal is due no later than the date and time listed on the Standard Form 1442, Block 13A.

The Step Two bid due date will be issued by amendment.

For further information, refer to Section 00 22 11.

11. JOINT VENTURE PROPOSAL REQUIREMENTS

When proposing as a joint venture, all members of the joint venture shall sign the SF 1442 and the bid bond unless a written agreement by the joint venture is furnished with the proposal designating one firm with the authority to bind the other member(s) of the joint venture. In addition, a copy of the joint venture agreement shall be submitted with the proposal. Failure to comply with the foregoing requirements may eliminate the proposal from further consideration. If this is an 8(a) or HubZone joint venture, the offeror shall ensure that it complies with the applicable requirements of 13 CFR Part 124 and 13 CFR Part 126, respectively. Regardless of any agreement, all members of the JV shall sign the contract and the performance and payment bonds.

12. DEVIATIONS AND EXCEPTIONS

Deviations and exceptions to the terms and conditions of the solicitation in either the technical or price proposal will not be accepted. Should the offer include any standard company terms and conditions that conflict with the terms and conditions of the solicitation, the offer will be determined “unacceptable” and, thus, ineligible for award.

Should the Offeror have any questions related to specific terms and conditions, these must be resolved prior to submission of the offer. Notwithstanding the above, if deviations and exceptions are included with the offer, the offer will be determined “unacceptable” and, thus, ineligible for award.

SECTION 00 22 11 - PROPOSAL SUBMISSION REQUIREMENTS, EVALUATION CRITERIA, BASIS OF AWARD ONE-STEP-BEST VALUE, DESIGN-BUILD (SINGLE AWARD)

The following have been modified:

SECTION 00 22 11

TWO-STEP SEALED BID
OVERVIEW, GENERAL SUBMISSION REQUIREMENTS, AND
INSTRUCTIONS, EVALUATIONS, AND CONTRACT AWARD

1. OVERVIEW

a. This is a "Two-Step Sealed Bid" Invitation for Bid for the Repair B1956 and Replace HVAC project located at Sheppard AFB, Texas. The Contracting Officer will award one (1) firm fixed-price construction contract to the responsive and responsible bidder whom the Government determines to have an acceptable Step One technical proposal, conforms to the solicitation requirements, is fair and reasonable, and bids the lowest overall price in Step Two.

b. The Step One Request for Technical Proposals is issued with approximately 80% complete sufficiently descriptive technical specifications and construction drawings. The information contained in Step One is not binding on the Government, and the actual delivery or performance requirements will be contained in the invitation issued under Step Two. The 80% specifications and drawings are not final or to be used for construction. Only those firms determined to be technically acceptable during Step One will be issued the 100% final technical specifications during Step Two.

c. The Two-Step Sealed Bidding procedure is a combination of competitive procedures designed to obtain the benefits of sealed bidding while ensuring only technically acceptable firms participate in the priced sealed bid. The process allows for the Step One technical proposal submission and evaluation to be performed concurrent with the development of the final 100% technical specifications and construction drawings. Step One ensures that only technically acceptable firms participate in the Step Two, the sealed bid process.

d. Step One under this process consists of the request for, submission of, evaluation and (if necessary) discussion of a technical proposal. Only one technical proposal may be submitted by each offeror. The proposals are evaluated for technical acceptability. The Step One technical proposal must not include prices or pricing information.

e. In Step One, offerors must submit technical proposals that are complete and acceptable without the need for additional explanation or information. The Government may make a final determination regarding a proposal's acceptability solely on the basis of the proposal as submitted. The Government may proceed with Step Two without requesting further information from any offeror; however, the Government may request additional information from, or enter into discussions with, the offerors of proposals that are determined to be reasonably susceptible of being made acceptable. Discussions will only be held if necessary, and if determined to be in the best interest of the Government.

f. A notice of "acceptable" or "unacceptable" will be forwarded to each Step One offeror upon completion of the technical proposal evaluation and final determination. The names of the offerors that submitted acceptable technical proposals will be listed on the Government's https://sam.gov website for the benefit of prospective subcontractors.

g. In Step Two, an amendment with the final 100% technical specifications and construction drawings will be issued to only those offerors whose technical proposals are determined to be acceptable in Step One. The normal sealed bidding process in FAR Part 14 will be followed. In Step Two, only bids based upon technical proposals determined to be acceptable, either initially or as a result of discussions, will be considered for award. Each bid submitted in Step Two must be based on the bidder's own technical proposal that was submitted, evaluated and determined to be acceptable in Step One. Bidders must comply with the 100% technical specifications and construction drawings and the bidder's acceptable technical proposal.

h. Contractor Team Arrangements are considered an arrangement in which (1) two or more companies form a partnership or joint venture to act as a potential prime contractor; or (2) a potential prime contractor agrees with one (1) or more other companies to have them act as its subcontractors under a specified Government contract or acquisition program.

The Government will recognize the integrity and validity of contractor team arrangements; provided, the arrangements are identified and company relationships are fully disclosed in an offer or, for arrangements entered into after submission of an offer, before the arrangement becomes effective. The Government will not normally require or encourage the dissolution of contractor team arrangements. The Offeror must identify the major or critical aspects of the requirement to be performed by those identified in the Contractor Team Arrangement.

i. Any Offeror submitting an offer in the name of a Joint Venture must include a fully executed copy of the Joint Venture Agreement with the offer. Joint Venture Agreements which require SBA approval may be submitted absent the requisite SBA Servicing Agency approving authorities' signature; however, the Offeror shall submit evidence from the Offeror's SBA Servicing Agency that the Offeror has notified and discussed the proposed Joint Venture for this project with the appropriate SBA personnel.

2. STEP ONE TECHNICAL PROPOSAL SUBMISSION INSTRUCTIONS

All offerors are required to submit a technical proposal with the minimum content as specified herein. Proposals without the minimum content may be rated other than "acceptable". Step One Technical Proposals shall be submitted electronically via Procurement Integrated Enterprise Environment (PIEE) Solicitation Module (https://piee.eb.mil), no later than the date and time established in Block 13 of the Standard Form (SF) 1442, or Block 14 of the most recent SF 30, as applicable:

Contracting Officer: Julie S. Hill at Julie.S.Hill@usace.army.mil
Contract Specialist: Lindsey M. Byfield at Lindsey.M.Byfield@usace.army.mil

Each submission shall contain the following information:

a. Solicitation No: W912BV23B0001
b. Bid Due Date and Time: [Block 13 of the SF 1442 or Block 14 of the most recent SF 30, as applicable]
c. Bid Validity Date: 90 Days

Proposals received after the date and time stated within Block 13 of the SF 1442 or Block 14 of the most recent SF 30, as applicable, will be considered late and will not be considered for award. To avoid rejection of a proposal, the offeror must ensure the e-mail submission is virus-free. The Government will follow FAR 14.406 if an e-mail bid is unreadable.

Offerors must be registered in the System for Award Management (SAM) when sending the submission to comply with the annual representations and certifications requirements. The offeror certifies with its offer that the representations and certifications included in SAM are current, accurate, and complete.

3. STEP ONE TECHNICAL PROPOSAL FORMAT REQUIREMENTS

Submit the Step One technical proposal via email in PDF format and Optical Character Recognition (OCR)* compatible and word searchable. Each section must be clearly labeled by solicitation number, project name, and Offeror's name.

*OCR is a common method of digitizing printed texts so that they can be electronically searched, stored more compactly, displayed on-line, and used in machine processes such as machine translation, text-to-speech, key data extraction and text mining.

Bidders shall enter a description for every file submitted. Bidders shall ensure all files are submitted in accordance with the submission requirements identified in PIEE.

Technical proposals will be organized with a table of contents as follows:

COVER LETTER: Solicitation number; Name, address, email, and telephone number of the offeror; Names, titles, emails, and telephone numbers of persons authorized to negotiate on the offeror's behalf with the Government in connection with this RFP. Name, title and signature of the person authorized to sign the proposal.

A statement specifying agreement with all terms, conditions and provisions included in the RFP; CAGE Code and UEI number for the offeror, and all teaming partners and / or joint ventures.

Note: The inclusion of any exceptions to the terms and conditions of the solicitation in the technical proposal, or the inclusion of any other terms and conditions that conflict with the terms and conditions of the solicitation may result in a determination that the proposal is unacceptable and thus ineligible for award. Resolve questions about the terms and conditions or technical requirements of the solicitation prior to submission of the proposal.

TAB A: Standard Form 1442, completed and signed by authorized individual(s) of the Offeror, include the offeror's UEI number in Block 14.

Acknowledgement of all amendments to the RFP in accordance with the instructions on the Standard Form 30 (amendment form).

TAB B: Section 00 45 00 – Representations and Certifications, Printed Entity Record from the online System for Award Management (SAM) database.

TAB C: Teaming & Joint Venture Arrangements: Offers submitting proposals using a teaming arrangement shall submit a fully executed copy of the teaming arrangement signed both by the subcontractor/teaming partner and the offeror and the narrative described in Section 00 21 00 Paragraph 11.

Offers submitted in the name of a joint venture must be signed in accordance with the terms and conditions specified in the joint venture agreement as evidenced in the proposal, including letters of commitment from the joint venture firms. See Section 00 21 00 Paragraph 11.

TAB D: Deviations and Exceptions

TAB E: All submission requirements for Factor 1: Bond Surety Letter & Bank Letter

TAB F: All submission requirements for Factor 2: Specialized Experience

TAB G: All submission requirements for Factor 3: Technical Approach

TAB H: All submission requirements for Factor 4: Past Performance

4. STEP ONE TECHNICAL PROPOSAL INQUIRIES AND QUESTIONS

See Section 00 21 00 Instructions for Procurement, Conditions, and Notices to Offerors.

5. ELIGIBILITY FOR CONTRACT AWARD

In accordance with the requirements of Part 9 of the Federal Acquisition Regulation (FAR), no contract shall be entered into unless the Contracting Officer ensures that all requirements of law, executive orders, regulations, and all other applicable procedures, including clearances and approvals, have been met. This includes the FAR requirement that no award will be made unless the Contracting Officer makes an affirmative determination of responsibility. To be determined responsible, a prospective prime contractor must meet the general standards in FAR Part 9 and any special standards set forth in the solicitation.

6. STEP ONE REQUEST FOR TECHNICAL PROPOSALS EVALUATION

The Government will evaluate each offeror's technical proposal based on how well the proposal addresses each of the evaluation factors listed below. Factors 1, Bond Surety Letter and Bank Letter, and 4, Past Performance, will be evaluated by the Government and either an "acceptable" or "unacceptable" rating will be determined by consensus of the Government evaluation board. Factors 2, Specialized Experience, and 3, Technical Approach, will be evaluated by the Government and either an "acceptable", "unacceptable" or "reasonably susceptible of being made acceptable" rating will be determined by consensus of the Government evaluation board. There are no relative weights assigned to the factors. A Step One acceptable technical proposal must be rated "acceptable" for all evaluation factors in order to receive an overall "acceptable" technical proposal rating.

6.1 General Technical Proposal and Evaluation Information:

6.1.1 The evaluation will be conducted in accordance with FAR Subpart 14.5, Two-Step Sealed Bidding. For this procurement, only one (1) technical proposal may be submitted by each offeror. The proposal must be complete without the need of additional explanation or information. The Government may proceed with Step Two without requesting further information from any offeror; however, the Government may request additional information from offerors of proposals that it considers "reasonably susceptible of being made acceptable."

6.1.2 Technical Proposals will be rated at the factor level. If any factor is determined to be "unacceptable", the entire proposal will be determined "unacceptable". A technical proposal may be determined to be "reasonably susceptible of being made acceptable" and therefore eligible for discussions; however, a proposal with a factor that is determined to be "unacceptable" will be eliminated from further consideration.

6.1.3 Technical proposals which do not provide the specified information in the specified location in accordance with the submission instructions may be rated other than "acceptable". The Government is under no obligation to search for information that is not in the specified locations. If an offeror submits alternates that are not requested, the information will not be evaluated.

6.1.4 In general, example projects or experience that the Government does not consider relevant for the purposes of evaluating experience will not be considered as a part of the minimum project requirement.

6.1.5 The degree of acceptability to the Government inherent in the content of the offeror's technical proposal will be a consideration under every evaluation factor.

6.1.6 If discussions are held with offerors whose proposals are considered "reasonably susceptible of being made acceptable" and a request for proposal revisions are requested, the revised proposal will be reevaluated in accordance with the criteria in the solicitation. After completion of discussions and evaluation of any revised proposals, the proposal will be determined as "acceptable" or "unacceptable". If determined "unacceptable", a notice of unacceptability will be forwarded to the offeror upon completion of the proposal's evaluation.

6.1.7 Any proposal which modifies or fails to conform to the essential requirements or specifications of the request for technical proposals will be considered nonresponsive and categorized as "unacceptable".

6.1.8 The offeror's conformance with the specified format and submission requirements will be considered during the technical evaluation. Failure to comply with the formatting and/or submission requirements may be seen as indicative of the type of problems that could be expected during contract performance. Lack of conformance and material omission(s) may cause the technical proposal to be rejected as "unacceptable".

6.1.9 The proposal submission instructions are written to give prospective offerors, where feasible, an indication of the level of detail desired by the Government. The offeror's failure to include information that the Government has indicated must be included will result in the proposal being found other than "acceptable" if inadequate detail is provided.

6.1.10 Do not include exceptions to the terms and conditions of the solicitation in the technical proposal submissions. The inclusion of any terms and conditions in the proposals that conflict with the terms and conditions of the solicitation may result in a determination that the proposal/bid is "unacceptable" and thus, ineligible to bid in Step Two. Resolve questions about the terms and conditions or technical requirements of the solicitation prior to submission of the proposal/bid; see "Proposal Inquiries and Questions", located above in Section 00 21 00.

6.1.11 Factor and Overall Technical Proposal Ratings. Each factor and the overall technical proposal as a whole will be given one of the ratings identified and defined as follows:

Factors 1 & 4 Ratings	**Definition**
Acceptable	Proposal meets the requirements of the RFP, and based on the offeror's performance record, the Government has a reasonable expectation that the offeror will successfully perform the required effort, or the offeror's performance record is unknown.
Unacceptable	Proposal does not meet the requirements of the RFP, and / or based on the offeror's performance record, the Government does not have a reasonable expectation that the offeror will be able to successfully perform the required effort.

Factors 2 & 3 Ratings	**Definition**
Acceptable	The proposal meets the requirements of the RFP and indicates an adequate approach and understanding of the requirements.
Reasonably Susceptible of Being Made Acceptable*	The proposal, as proposed, cannot be rated as *acceptable* because of error(s), omissions(s) or deficiency(ies) which are capable of being corrected without a major rewrite or revision of the proposal.
Unacceptable	The proposal does not meet the requirements of the RFP.

*The rating of *Reasonable Susceptible of Being Made Acceptable* will not be used for the overall technical proposal rating.

6.1.12 Submission Requirements and Evaluation Criteria for the Technical Proposal

The information provided in this section will be used in evaluating the offeror's specialized technical experience and proposed technical approach, specific to this solicitation.

6.2 Factor 1: Bond Surety Letter and Bank Letter

6.2.1 Submission Requirements:

6.2.1.1 Proposing firm must provide a letter from a surety appearing on the Department of Treasury Circular 570 (list of approved sureties at https://www.fiscal.treasury.gov/surety-bonds/list-certified-companies.html) stating:

a. The bidder is able to provide a project bid bond in Step Two for an individual project valued at a minimum of $20M.
b. The bidder is able to obtain performance and payment bonds for an individual project valued at a minimum of $20M should it be awarded the contract.

6.2.1.2 Financial statement and bank letter that verify that sufficient funds will be available to perform the work on an individual construction project valued at a minimum of $20M.

6.2.2 Evaluation Criteria:

The Government will evaluate all the proposing firm's submission documents and categorize the proposal with one (1) combined technical evaluation for this factor.

6.2.3 Minimum Acceptability Criteria:

6.2.3.1 The bidder provides a letter from a surety appearing on the Department of Treasury Circular 570 stating it is able to provide a project bid bond in Step Two for an individual project valued at a minimum of $20M.

6.2.3.2 The bidder provides a letter or other documentation from a surety appearing on the Department of Treasury Circular 570 stating it is able to obtain performance and payment bonds for an individual project valued at a minimum of $20M should it be awarded the contract.

6.2.3.3 The bidder provides financial statements and a bank letter verifying that sufficient funds will be available to perform the work on an individual construction project valued at a minimum of $20M.

Note: If a firm is found acceptable and qualified to participate in Step Two, a bid bond is required with its Step Two bid in accordance with FAR 52.228-1, Bid Guarantee. If a firm is selected for award, it must provide payment and performance bonding in accordance with FAR 52.228-15, Performance and Payment Bonds – Construction.

6.3 Factor 2: Specialized Experience

6.3.1 Submission Requirements:

Submit a minimum of three (3) example projects and a maximum of five (5) example projects completed within the last 6 years demonstrating the proposing firm's recent, relevant experience. If more than five projects are submitted, only the first five will be evaluated. The projects submitted shall be limited to no more than five pages for each project submission. Additional pages above the limit may not be evaluated.

Multiple Award Task Order Contracts (MATOCs) or any other type of task-order contracts that provide for the issuance of task orders for the performance of tasks will not be considered projects for the purposes of this evaluation. Only individual task orders issued under such contracts will be evaluated as projects; however, a phased project using phased task orders for a single customer with multiple inter-dependent facilities on a single site may be considered a project for the purposes of this evaluation. Project descriptions that do not clearly describe the proposing firm's or team member's experience, the scope of the project, or the periods of project performance will not be considered.

The information that is required for Factor 2, below, is provided in the template Attachment A, Experience in Relevant Projects, which can be extended as necessary. Offerors are not required to use the form itself as part of their proposal, but the information requested for Factor 2 must be in the offeror's proposal and should be in the same format as the template.

The following information is required for each submitted project experience:

a. Project Title
b. Location
c. Contract Number
d. Type of Contract: Indicate Firm Fixed Price; Cost Plus Fixed Fee; etc.
e. Total Dollar Amount at Award and Completion: Total amount of the proposing firm's contract or subcontract (if a key subcontractor)
f. Project Delivery Method: Indicate Design/Bid/Build; Design/Build; Integrated Design; Design Only; etc.
g. Role of Proposing Firm: Prime contractor or key subcontractor. If a subcontractor, state who is the prime contractor. State if the example project represents a Joint Venture. If a Joint Venture, name the Joint Venture's parties. Indicate type of work and percentage of work performed by the parties.

h. Brief Description of Project: Provide a narrative with details about the proposing firm's role and the relevancy to this project
i. Project Relevancy: Address any relevancy of the submitted project using, at a minimum, the relevancy criteria (a) through (f) below
j. Construction Start and Completion Dates: Project construction must be identified as complete or substantially complete. If a proposing firm presents a project that is substantially complete, the proposal must include an explanation of why that project should be considered.
k. Customer / End User's Primary Point of Contact: Name, relationship to project, agency/firm, phone number, and e-mail address. The Government may contact and interview project references. Reference information will not be revealed to other parties.
l. Procuring Activity Point of Contact: Name, relationship to project, agency/firm, phone number, and e-mail address. The Government may contact and interview project references. Reference information will not be revealed to other parties.

6.3.2 Evaluation Criteria:

The Government will evaluate each submitted project's extent of recent and relevant experience compared to this project's size, scope of work, and performance requirements. The Government will categorize the proposal with one (1) combined technical evaluation for this factor.

A *recent* project is a project that is complete, or substantially complete within six (6) years of this request for technical proposal issue date. If a proposing firm submits a project as substantially complete within the 6-year period, the proposal must include an explanation why that project should be considered substantially complete.

The *relevancy* of a submitted projects must be substantiated by the proposing firm's role, work, size, scope, and complexity similar to the requirements in this project. In making this determination, the Government will use the following criteria to establish the acceptable relevancy of a submitted project (this is not an exclusive list and each relevant project does not need to meet all of the criteria) for experience with:

a. Full replacement of building systems, to include mechanical systems, fire suppression, plumbing, electrical and lighting
b. Commissioning of building mechanical systems
c. Repair of building interior surfaces and finishes
d. Large (>50,000 square foot) building facility project
e. Constructing a project on a military installation
f. Phasing construction operations in occupied facilities

6.3.3 Minimum Acceptability Criteria:

A firm's acceptable proposal for this factor must include:

a. At least two of the submitted projects must have similar scope criteria as listed above in item a & b.
b. At least one submitted project must have similar scope criteria as listed in item a, c, & d.
c. One of the submitted projects must comply with item a and have a contract value of at least $10M.
d. Determined to meet the recency requirements above.
e. Determined to meet the relevancy requirements above.

The project descriptions and relevancy narratives must clearly articulate the relevancy in sufficient detail to determine technical capability. The more similarities an example project has with the prospective contract, the greater the degree of relevancy.

6.4 Factor 3: Technical Approach

6.4.1 Submission Requirements:

The proposing firm must clearly communicate its proposed technical approach for the solicited project which meets the attached 80% technical specifications and construction drawings. The TAB G technical approach, including all narrative and charts and other grahics, is limited to twenty-five (25) pages. The proposal must include, as a minimum, the following elements:

6.4.1.1 Construction Approach to include:

a. Demolition and disposal of existing, and installation of new building systems as specified in the contract documents
b. Commissioning of the new building HVAC controls
c. Description of your QC system and Safety Plan
d. Coordination between subcontractors
e. Construction data management and reporting requirements.

6.4.1.2 Conceptual Schedule Management to include:

a. Sequencing and managing important construction activities and milestones that demonstrates a firm understanding of how to schedule and manage the project's construction and data management.
b. The schedule must include durations in calendar days that meets the contract requirements. (Note: this is a concept schedule used to assure the contractor understands the scope and sequencing of the project and is not considered a post award construction submittal).
c. Coordination between features of construction/sequencing work/staging.

6.4.1.3 Staffing and Management Plan to include:

a. Management organization chart of proposing firm (prime contractor) and Key Staff including Construction Project Manager, Quality Control Manager (CQC System Manager), Site Superintendent, and Site Safety & Health Officer
b. Key subcontractors
c. Work assignments of specialized skills and trades.

6.4.2 Evaluation Criteria:

6.4.2.1 The Government will evaluate the technical approach in its entirety and categorize the proposal with one (1) combined technical evaluation for this factor.

6.4.2.2 The proposing firm's technical approach narrative must be in an organized manner that acceptably addresses the elements and sub-elements listed in the submission requirements. The proposed technical approach must meet all the attached draft plans, specifications, and contract requirements, and be commensurate with this project's size, scope, and complexity.

6.4.3 Minimum Acceptability Criteria:

6.4.3.1 The proposing firm's technical approach must, at a minimum, include and address all the elements and elements listed in the submission requirements.

6.4.3.2 A proposing firm demonstrates an acceptable technical approach by meeting the minimum submission requirements for this factor and providing the Government with a technical approach that meets all of the attached plans, specifications, and contract requirements, commensurate with this project's size, scope, and complexity.

6.5 Factor 4: Past Performance

6.5.1 Submission Requirements:

Submit past performance information on each project submitted for Factor 2. DO NOT provide Past Performance references for projects other than those project examples provided for Factor 2. The quantity of projects submitted for this factor is the same as the quantity of projects submitted for the Factor 2 submission requirements, a minimum of three (3) and a maximum of five (5).

The Past Performance Questionnaire (PPQ) (Attachment B) is provided for the offering firms to submit to the client of each project the offering firm includes in its submission requirements for Factor 2. Ensure correct phone numbers and email addresses are provided for the client's point of contact. The completed PPQs should be submitted with the Step One technical proposals. If the client requests, questionnaires may be submitted directly to the Government's point of contact, lindsey.m.byfield@usace.army.mil via email prior to the Step One technical proposal closing date and time.

Note: If any of the projects are Government contracts with a completed CPARS, please only complete Blocks 1 through 5 of the PPQ form (Attachment B) and attach it to the front of the CPARS rating. Be sure to include the POC's information of the client and the contract number of the project.

6.5.2 Evaluation Criteria:

The past performance evaluation is an assessment of the offeror's probability of meeting the minimum past performance solicitation requirements. This assessment is based on the offeror's record of relevant and recent past performance information that pertain to the products and/or services outlined in the solicitation requirements. The Government will at a minimum, evaluate the successful performance of all project examples submitted for Factor 2 and categorize the proposal with one (1) combined evaluation for this factor.

The burden of providing detailed, current, accurate and complete past performance information rests with the proposing firm. If any firm has multiple functions or divisions, the Government will only evaluate past performance of the division or unit submitting the offer or of the team member. The prime contractor will be rated on its own performance. A prime contractor may not establish past performance based on the past performance of its proposed key personnel, apart from that of the entity.

In accordance with FAR 15.305 and DFARS 215.305, the currency and relevance of the information, source of the information, context of the data, and general trends in contractor's performance will be considered. However, the comparative assessment in FAR 15.305(a)(2)(i) does not apply. Therefore, past performance will be rated on an "acceptable" or "unacceptable" basis only.

In the case of an offeror without a record of relevant past performance or for whom information on past performance is not available or so sparse that no meaningful past performance rating can be reasonably assigned, the offeror may not be evaluated favorably or unfavorably on past performance (see FAR 15.305(a)(2)(iv)). Therefore, the offeror will be determined to have unknown (or "neutral") past performance. In the context of acceptability/unacceptability, a neutral rating will be considered "acceptable."

The Government may also review past performance information from any sources available to the Government, to include, but not limited to, the Federal Awardee Performance and Integrity Information System (FAPIIS), Contractor Assessment Reporting System (CPARS) or other databases using all CAGE/DUNS numbers of team members (partnership, joint venture, teaming arrangement, or parent company/subsidiary/affiliate) identified in the Offeror's proposal; interviews with Program Managers, Contracting Officers, and Fee Determining Officials; and the Defense Contract Management Agency. The Government reserves the right to check any or all cited references to verify supplied information and to assess owner satisfaction. The evaluation may take into account the number and severity of problems, the demonstrated effectiveness of corrective actions taken, and the overall work record.

6.5.3 Minimum Acceptability Criteria:

Past performance information must be submitted for each project submitted for Factor 2. This amounts to the same Factor 2 minimum of three (3) example projects and a maximum of five (5) example projects completed within the last 6 years from the date of the Step One solicitation issuance date demonstrating the proposing firm's recent, relevant experience.

The recency and relevancy of each submitted project's past performance evaluation will use the same determination made during the Factor 2 evaluation. Any additional recency and relevancy determinations of past performance information from other sources available to the Government will follow the same criteria used during the Factor 2 evaluation.

A proposing firm demonstrates acceptable past performance by meeting the minimum submission and past performance solicitation requirements and based on the offeror's satisfactory or higher performance record, the Government has a reasonable expectation that the offeror will successfully perform the required efforts in the requirements. The Government will have confidence in the firm's probability to successfully supply products and services that meet all the contract's plans, specifications requirements.

7. STEP TWO INVITATION FOR BID, EVALUATION, AND AWARD

Step Two in the process involves the submission of sealed priced bids by those offerors who submitted acceptable technical proposals in Step One.

The Step-Two Invitation for Bid (IFB) will be issued to the acceptable firms as an amendment to the solicitation and include the final 100% technical specifications and construction drawings, final bid schedule, and other final bidding information. The priced bids will be due no later than the date and time listed in the amendment. The bids submitted in Step Two will be evaluated and the award made in accordance with Subparts 14.3 and 14.4.

In Step Two, only bids based upon technical proposals determined to be "acceptable", either initially or as a result of discussions, will be considered for award. Each bid in Step Two must be based on the bidder's own technical proposal that was submitted, evaluated, and determined to be acceptable in Step One.

Bidders must comply with the final technical specifications and construction drawings and the bidder's acceptable technical proposal. Do not include exceptions to the terms and conditions of the solicitation in the bid submissions. The inclusion of any terms and conditions in the bid that conflicts with the terms and conditions of the solicitation may result in a determination that the proposal/bid is unacceptable and thus ineligible for Step Two and award. Resolve questions about the terms and conditions or technical requirements of the solicitation prior to submission of the proposal/bid; see "Proposal Inquiries and Questions", located in Section 00 21 00.

SECTION 00 72 00 - CONTRACT CLAUSES

The following have been modified:

52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than the proposed calendar days for completion.

The contractor shall propose a contract duration in number of calendar days on the schedule in Tab G Technical

Approach. If accepted, the proposed duration shall become the required contract duration. Offerors shall propose a contract duration that reflects value engineering, as well as maximum efficiency and cost savings to the Government. Offerors shall clearly indicate the key activities impacting the critical path in which time has been extended to reduce risk and annotate the nature and perceived severity of risk. During the subsequent comparison between proposals, differences between proposed contract durations of at least three (3) weeks (differences of 21 calendar days between proposals) will be considered an advantage to the Government, with greater differences also considered, accordingly. No advantage will be considered between proposals for differences less than 21 calendar days.The time stated for completion shall include final cleanup of the premises.

(End of clause)

52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) The site visit to review the 'Repair Building 1956 and Replace HVAC' project has been scheduled for Tuesday, 1 NOV 2022 from 0900-1100 CDT. Offerors must submit in writing, via e-mail, the firm's name, address, point of contact, telephone number, and number of personnel planning to attend to Ms. Lindsey Byfield (lindsey.m.byfield@usace.army.mil) no later than five (5) working days prior to the site visit. A Government issued ID (i.e., driver's license) is required to gain access to the installation. Each attendee who needs a Visitor Pass will need to provide their name, date of birth, and a valid driver's license or state ID number with state of issue. USACE will need to submit an entry access list to the Sheppard AFB Visitor Center before the visit for prior approval.

Offerors are reminded to allow sufficient time to pass through security to gain entrance to the installation.

(End of provision)

(End of Summary of Changes)

SECTION 00 22 11 - ATTACHMENT A
COMPANY SPECIALIZED EXPERIENCE - CONSTRUTION OR PRIME CONTRACTOR

Provide the following information to show examples of construction projects your company completed within the last six (6) years indicating experience with projects of similar type and scope. Use one form per project.

a. Type of Facility Represented_____

b. Your Firm's Name _____

c. Name of Project and Contract Number _____

d. Location of Project_____

e. Project Contract Type _____

f. Owner _____

g. General Scope of Project (address how this relates to this solicitation)

h. Your Role (Prime, Joint Venture, or Subcontractor) and Work Your Company Self-Performed (also include any proposed team members that were directly involved in this project, including work performed, roles and responsibilities) :

i. Provide a list of the management team and their responsibility at a minimum include Project Manager, Quality Control Representative, and Construction Superintendent.

j. Construction Cost _____

k. Extent and Type of Work You Subcontracted Out _____

l. Dates Construction: Began_____Completed_____

m. Your Performance Evaluation by Owner, if known _____

n. Were You Terminated or Assessed Liquidated Damages? _____
(If either is "Yes", attach an Explanation)

o. Owner's Point of Contact for Reference (Name and Company) _____

p. Current Telephone Number of Reference POC_____

COMPANY SPECIALIZED EXPERIENCE - DESIGN FIRM OR IN-HOUSE DESIGN CAPABILITY

Provide the following information to show examples of projects your company constructed within the last six (6) years indicating experience with projects of similar type and scope. Use one form per project.

a. Type of Facility Represented _____

b. Your Firm's Name _____

c. Name of Project and Contract Number _____

d. Location of Project _____

e. Project Contract Type _____

f. Owner _____

g. General Scope of Construction Project (address how this relates to this solicitation)

h. Summary of Your Role in Design of this Project (also include any proposed team members that were directly involved in this project, including work performed, roles and responsibilities):

i. Provide a list of the management team and their responsibility at a minimum include, Design Project manager and Design Quality Control Representative.

j. Identify Estimated ("E") or Actual ("A") Construction Cost _____

k. Extent and Type of Work You Subcontracted _____

l. Dates Design: Began_____Completed_____

m. Dates Construction: Began_____Completed_____

n. Your Performance Evaluation, if known _____

o. Were You Terminated or Assessed Liquidated Damages? _____
(If either is "Yes", attach an Explanation)

p. Owner's Point of Contact for Reference (Name and Company) _____

q. Current Telephone Number of Reference POC _____

SECTION 00 22 11 - ATTACHMENT B
PAST PERFORMANCE QUESTIONNAIRE

NAVFAC/USACE PAST PERFORMANCE QUESTIONNAIRE (Form PPQ-0)
CONTRACT INFORMATION (Contractor to complete Blocks 1-4)
1. Contractor Information Firm Name: CAGE Code: Address: DUNs Number: Phone Number: Email Address: Point of Contact: Contact Phone Number:
2. Work Performed as: Prime Contractor Sub Contractor Joint Venture Other (Explain) Percent of project work performed: If subcontractor, who was the prime (Name/Phone #):
3. Contract Information Contract Number: Delivery/Task Order Number (if applicable): Contract Type: Firm Fixed Price Cost Reimbursement Other (Please specify): Contract Title: Contract Location: Award Date (mm/dd/yy): Contract Completion Date (mm/dd/yy): Actual Completion Date (mm/dd/yy): Explain Differences: Original Contract Price (Award Amount): Final Contract Price (*to include all modifications, if applicable*): Explain Differences:
4. Project Description: Complexity of Work High Med Routine How is this project relevant to project of submission? (*Please provide details such as similar equipment, requirements, conditions, etc.*)
CLIENT INFORMATION (Client to complete Blocks 5-8)
5. Client Information Name: Title: Phone Number: Email Address:
6. Describe the client's role in the project:
7. Date Questionnaire was completed (mm/dd/yy)**:**
8. Client's Signature:

NOTE: NAVFAC/USACE requests that the client complete this questionnaire and submit it directly back to the Government's contract specialist, Lindsey Byfield, via email at lindsey.m.byfield @usace.army.mil. The offeror will submit the completed questionnaire to USACE with its proposal, and may duplicate this questionnaire for future submission on USACE solicitation. Clients are highly encouraged to submit questionnaires directly to the offeror. However, questionnaires may be submitted directly to USACE. Please contact the offeror for USACE POC information. The Government reserves the right to verify any and all information of this form.

TO BE COMPLETED BY CLIENT

PLEASE CIRCLE THE ADJECTIVE RATING WHICH BEST REFLECTS YOUR EVALUATION OF THE CONTRACTOR'S PERFORMANCE.

1. QUALITY:						
a) Quality of technical data/report preparation efforts	E	VG	S	M	U	N
b) Ability to meet quality standards specified for technical performance	E	VG	S	M	U	N
c) Timeliness/effectiveness of contract problem resolution without extensive customer guidance	E	VG	S	M	U	N
d) Adequacy/effectiveness of quality control program and adherence to contract quality assurance requirements (without adverse effect on performance)	E	VG	S	M	U	N
2. SCHEDULE/TIMELINESS OF PERFORMANCE:						
a) Compliance with contract delivery/completion schedules including any significant intermediate milestones. *(If liquidated damages were assessed or the schedule was not met, please address below)*	E	VG	S	M	U	N
b) Rate the contractor's use of available resources to accomplish tasks identified in the contract	E	VG	S	M	U	N
3. CUSTOMER SATISFACTION:						
a) To what extent were the end users satisfied with the project?	E	VG	S	M	U	N
b) Contractor was reasonable and cooperative in dealing with your staff (including the ability to successfully resolve disagreements/disputes; responsiveness to administrative reports, businesslike and communication)	E	VG	S	M	U	N
c) To what extent was the contractor cooperative, businesslike, and concerned with the interests of the customer?	E	VG	S	M	U	N
d) Overall customer satisfaction	E	VG	S	M	U	N
4. MANAGEMENT/ PERSONNEL/LABOR						
a) Effectiveness of on-site management, including management of subcontractors, suppliers, materials, and/or labor force?	E	VG	S	M	U	N
b) Ability to hire, apply, and retain a qualified workforce to this effort	E	VG	S	M	U	N
c) Government Property Control	E	VG	S	M	U	N
d) Knowledge/expertise demonstrated by contractor personnel	E	VG	S	M	U	N
e) Utilization of Small Business concerns	E	VG	S	M	U	N
f) Ability to simultaneously manage multiple projects with multiple disciplines	E	VG	S	M	U	N
g) Ability to assimilate and incorporate changes in requirements and/or priority, including planning, execution and response to Government changes	E	VG	S	M	U	N
h) Effectiveness of overall management (including ability to effectively lead, manage and control the program)	E	VG	S	M	U	N
5. COST/FINANCIAL MANAGEMENT						
a) Ability to meet the terms and conditions within the contractually agreed price(s)?	E	VG	S	M	U	N
b) Contractor proposed innovative alternative methods/processes that reduced cost, improved maintainability or other factors that benefited the client	E	VG	S	M	U	N
c) If this is/was a Government cost type contract, please rate the Contractor's timeliness and accuracy in submitting monthly invoices with appropriate back-up documentation, monthly status reports/budget variance reports, compliance with established budgets and avoidance of significant and/or unexplained variances (under runs or overruns)	E	VG	S	M	U	N
d) Is the Contractor's accounting system adequate for management and tracking of costs? *If no, please explain in Remarks section.*		Yes			No	
e) If this is/was a Government contract, has/was this contract been partially or completely terminated for default or convenience or are there any pending		Yes			No	

terminations? *Indicate if show cause or cure notices were issued, or any default action in comment section below.*						
f) Have there been any indications that the contractor has had any financial problems? *If yes, please explain below.*		Yes			No	
6. SAFETY/SECURITY						
a) To what extent was the contractor able to maintain an environment of safety, adhere to its approved safety plan, and respond to safety issues? (Includes: following the users rules, regulations, and requirements regarding housekeeping, safety, correction of noted deficiencies, etc.)	E	VG	S	M	U	N
b) Contractor complied with all security requirements for the project and personnel security requirements.	E	VG	S	M	U	N
7. GENERAL						
a) Ability to successfully respond to emergency and/or surge situations (including notifying COR, PM or Contracting Officer in a timely manner regarding urgent contractual issues).	E	VG	S	M	U	N
b) Compliance with contractual terms/provisions *(explain if specific issues)*	E	VG	S	M	U	N
c) Would you hire or work with this firm again? *(If no, please explain below)*		Yes			No	
d) In summary, provide an overall rating for the work performed by this contractor.	E	VG	S	M	U	N

Please provide responses to the questions above (*if applicable*) and/or additional remarks. Furthermore, please provide a brief narrative addressing specific strengths, weaknesses, deficiencies, or other comments which may assist our office in evaluating performance risk *(please attach additional pages if necessary)*.

SECTION 01 91 00.15

TOTAL BUILDING COMMISSIONING
05/16

THIS SECTION TO BE EDITED BY MECHANICAL ENGINEER.

PART 1 GENERAL

1.1 SUMMARY

Commission the building systems listed herein. Employ the services of an independent Commissioning Firm. The Commissioning Firm must be a 1st tier subcontractor of the General or Prime Contractor and must be financially and corporately independent of all other subcontractors. The Commissioning Firm must employ a Lead Commissioning Specialist that coordinates all aspects of the commissioning process. Conform to the commissioning procedures outlined in this specification.

1.2 SYSTEMS TO BE COMMISSIONED

Commission the following systems:

[Heating, Ventilating, Air Conditioning, and Refrigeration Systems (HVAC)
][Building Automation System
][Utility Monitoring and Control System
][Lighting Systems
][Power Distribution Systems
][Power Generation Systems
][Renewable Energy Systems
][Service Water Heating Systems
][Plumbing Systems
][Natural Gas and Propane Systems
][Water Pumping and Mixing Systems
][Irrigation Systems
][Water Harvesting/Reclaim Systems
][Compressed Air and Vacuum Systems
][Energy and Water Utility Metering Systems and Sub-Meters
] Building Envelope: moisture and thermal integrity and air tightness
[Fenestration Control Systems
]

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 202 (2013) Commissioning Process for Buildings and Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline (2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard	(2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1429	(1994) HVAC Systems Commissioning Manual, 1st Edition

1.4 COMMUNICATION WITH THE GOVERNMENT

The Lead Commissioning Specialist (CxC) must submit all plans, schedules, reports, and documentation directly to the concurrent with submission to the . The Lead Commissioning Specialist must have direct communication with the regarding all elements of the commissioning process; however, the Government has no direct contract authority with the Lead Commissioning Specialist.

1.5 SEQUENCING AND SCHEDULING

1.5.1 Sequencing

Complete the following prior to starting Functional Performance Tests of mechanical systems:

a. All equipment and systems have been completed, cleaned, flushed, disinfected, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.

. Testing, Adjusting, and Balancing has been completed and the Testing, Adjusting, and Balancing Report, been submitted and approved in accordance with Specification Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

. The building envelope is enclosed according to contract documents with final construction completed[, the Air Barrier Pressure Tests have been completed and the Air Leakage Test Reports and Diagnostic Test Reports have been submitted and approved in accordance with Specification Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS].

. The Pre-Functional Checklists have been submitted and approved.

. The Certificate of Readiness for mechanical systems has been submitted and approved.

Complete the following prior to starting Functional Performance Tests of the electrical systems:

a. All electrical, power generation, and lighting equipment and systems have been completed, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.

b. The building envelope is enclosed according to contract documents with final construction completed.

c. Ceiling tiles, floor coverings, and window coverings are in place.

d. The Certificate of Readiness for electrical systems has been submitted and approved.

[e. Lamps have completed a minimum 100 hour burn-in period.

][f. Furniture is in place.

]1.5.2 Project Schedule

Include the following tasks in the project schedule required by Section 01 32 01.00 10 PROJECT SCHEDULE. Ensure sufficient time is scheduled to accommodate the requirements of this specification section. The order of items listed below is not intended to imply a specified sequence:

[a. Submission and approval of the Commissioning Firm and Commissioning Specialist

][b. Submission and approval of the Testing, Adjusting, and Balancing (TAB) Firm and TAB Specialist specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][c. Submission of the Design Review Report specified herein.

][d. Submission of the Design Review Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

][e. Submission and approval of the Construction Phase Commissioning Plan

][f. Installation of permanent utilities (gas, water, electric)

][g. Building Envelope Construction

][h. Submission and approval of the Building Envelope Inspection Checklists]

[i. Air Barrier Pressure Tests specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS

][j. Drainage and Vent, Building Sewers, Water Supply Systems and Backflow Prevention Assembly Tests specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE

][k. Factory Acceptance Testing for each of the systems to be commissioned as required by technical specifications

][l. Manufacturer's Equipment Start-Up for each of the systems to be commissioned.

][m. Potable Water System Flushing specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE

][n. Operational Tests of the plumbing system specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

][o. Potable Water System Disinfection specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE

][p. Submission and approval of the TAB Schematic Drawings, Report Forms, and Procedures specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

][q. Submission and approval of Duct Air Leakage Test Procedures specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][r. Duct Air Leakage Test Execution specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][s. Submission and approval of the Final Duct Air Leakage Test Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][t. Testing, Adjusting, and Balancing (TAB) Field Work required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][u. Submission and approval of the TAB Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][v. TAB Field Acceptance Testing required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

][w. Submission and approval of the Start-Up Testing Report specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

][x. Submission and approval of the Performance Verification Test Procedures specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.

][y. Performance Verification Tests required by Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

][z. Performance Verification Test Report specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

][aa. Pre-Functional Checklist Submittal

][bb. Functional Performance Testing for each system to be commissioned

][cc. Integrated Systems Tests

][dd. Post-Test Deficiency Correction for each system to be commissioned

][ee. Re-Testing

]

[gg. Training for each of the systems to be commissioned

][hh. [Systems Manual][Computerized Maintenance Management System Manual], submission and approval

][ii. Seasonal Testing

][1.5.3 Phasing

[_____].

]1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Commissioning Firm; G

Lead Commissioning Specialist; G

Technical Commissioning Specialists; G

Commissioning Firm's Contract; G

SD-06 Test Reports

Design Review Report; G

Interim Construction Phase Commissioning Plan; G

Final Construction Phase Commissioning Plan; G

Template Building Envelope Inspection Checklists; G

Building Envelope Inspection Checklists; G

Pre-Functional Checklists; G

Issues Log

Commissioning Report; G

Post-Construction Trend Log Report; G

SD-07 Certificates

Certificate of Readiness; G

SD-10 Operation and Maintenance Data

Training Plan; G

Training Attendance Rosters; G

[Systems Manual][Computerized Maintenance Management System Manual]; G

SD-11 Closeout Submittals

Construction Phase Commissioning Plan; S

Final Commissioning Report; S

1.7 COMMISSIONING FIRM

Provide a Commissioning Firm that is certified in commissioning by one of the following: the AABC Commissioning Group (ACG); the National Environmental Balancing Bureau (NEBB); the International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB), the Building Commissioning Association (BCA); the Association of Energy Engineers (AEE).[The Commissioning Firm may employ a commissioning professional certified by the University of Wisconsin-Madison or the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) as required in paragraph LEAD COMMISSIONING SPECIALIST as an alternative to certification of the Commissioning Firm.] The Commissioning Firm must be certified in all systems to be commissioned to the extent such certifications are available from the certifying body. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed Commissioning Firm or Lead Commissioning Specialist in detail. Any firm or commissioning professional that has been the subject of disciplinary action by the certifying body within the five years preceding contract award is not eligible to perform any duties related to commissioning.

a. Submit the Commissioning Firm's certification of qualifications including the name of the firm and certifications no later than [30][60] calendar days after Notice to Proceed. Submit [one][_____] hard copy and an electronic copy.

b. The Commissioning Firm's and Commissioning Specialists' certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the firm or a specialist loses a certification during this period, immediately notify the and submit another Commissioning Firm or Commissioning Specialist for approval. All work specified in this specification section performed by the Commissioning Firm or associated Commissioning Specialists is invalid if the Commissioning Firm or Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.

c. The Commissioning Firm must oversee and assist the General or Prime Contractor with the work specified herein. Submit the Commissioning Firm's Contract including the Scope of Work associated with the paragraph POST-CONSTRUCTION SUPPORT no later than 30 calendar days after approval of the Commissioning Firm. Submitonly an electronic copy to the Contracting Officer.

d. The Commissioning Firm may act as the Pressure Test Agency required by Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS provided that all qualification requirements of that specification section are met.

1.7.1 Lead Commissioning Specialist (if applicable)

The Commissioning Firm must provide a Lead Commissioning Specialist (CxC) that has a minimum of five years of commissioning experience, including two projects of similar size and complexity, and that is one of the following: a NEBB qualified Systems Commissioning Administrator (SCA); ACG Certified Commissioning Authority (CxA); ICB/TABB Certified Commissioning Supervisor; BCA Certified Commissioning Professional (CCP); AEE Certified Building Commissioning Professional (CBCP); University of

Wisconsin-Madison Qualified Commissioning Process Provider (QCxP); ASHRAE Commissioning Process Management Professional (CPMP).

a. Submit the Lead Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than [30][60] calendar days after Notice to Proceed. Submit only an electronic copy to the Contracting Officer.

b. The Lead Commissioning Specialists certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the specialist loses a certification during this period, immediately notify the and submit another Lead Commissioning Specialist for approval. All work specified in this specification section to be performed by the Lead Commissioning Specialist is invalid if the Lead Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.

c. The Lead Commissioning Specialist must lead and oversee the commissioning work specified herein and be the primary point of contact for the Government regarding the commissioning work.

1.7.2 Technical Commissioning Specialists

Technical Commissioning Specialists, employed by the Commissioning Firm and that have the following qualifications, must perform the technical work specified herein associated with each system to be commissioned:

a. The technical work associated with mechanical systems including [Heating, Ventilating, Air Conditioning, and Refrigeration Systems]; [Building Automation System]; [Utility Monitoring and Control System]; [Service Water Heating Systems]; [Plumbing Systems]; [Water Pumping and Mixing Systems]; [Irrigation Systems]; [Compressed Air and Vacuum Systems]; [Energy and Water Utility Metering Systems] must be performed by a Commissioning Specialist certified by NEBB, ACG, ICB/TABB, or BCA in the commissioning of HVAC systems with five years of experience in the commissioning of HVAC systems.

b. The technical work associated with electrical systems including [Lighting Systems]; [Power Distribution Systems]; [Power Generation Systems]; [Renewable Energy Systems] must be performed by an engineering technician certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies (NICET) with five years of experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

c. The technical work associated with the Building Envelope system must be performed by a registered architect with five years of building envelope design or construction experience. [The Commissioning Firm team member with the required experience related to the building envelope may act as the Air Barrier Inspector required by specification section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM provided that all qualification requirements of that specification section are met.] [The Commissioning Firm team member with the required experience related to the building envelope may act as the thermographer required by specification section 07 05 23 PRESSURE

TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS provided that all of the qualification requirements of that specification section are met.]

d. Submit the Technical Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 30 calendar days after Notice to Proceed. Submit only an electronic copy to the Contracting Officer.

1.7.3 Commissioning Standard

Comply with the requirements of the commissioning standard under which the Commissioning Firm and Specialists qualifications are approved. When the firm and specialists are certified by BCA, AEE, ASHRAE, or the University of Wisconsin-Madison, comply with the requirements of one of the acceptable standards unless otherwise stated herein. The acceptable standards are ACG Commissioning Guideline, NEBB Commissioning Standard, SMACNA 1429, or ASHRAE 202. Comply with applicable NETA and NICET testing standards for electrical systems.

a. Implement all recommendations and suggested practices contained in the Commissioning Standard and electrical test standards.

b. Use the Commissioning Standard for all aspects of Commissioning, including calibration of instruments.

c. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, adhere to the manufacturer calibration recommendations.

d. All quality assurance provisions of the Commissioning Standard such as performance guarantees are part of this contract.

e. The Commissioning Specialists must develop commissioning procedures for any systems or system components not covered in the Commissioning Standard.

f. Use any new requirements, recommendations, and procedures published or adopted prior to contract solicitation by the body responsible for the Commissioning Standard.

[1.8 SUSTAINABILITY THIRD PARTY CERTIFICATION (TPC)

The Commissioning Specialists must execute and document the commissioning activities required of the Commissioning Authority for the purposes of complying with the Third Party Certification (TPC) requirements for the project in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. Provide all commissioning documentation required to meet the TPC requirements.

]1.9 ISSUES LOG

The Lead Commissioning Specialist must develop and maintain an Issues Log for tracking and resolution of all deficiencies discovered through commissioning review, inspection, and testing. Include the date of final resolution of issues as confirmed by the Commissioning Specialist. Submit the Issues Log on a monthly basis at a minimum. At any point during construction, any commissioning team member finding deficiencies may

communicate those deficiencies in writing to the Commissioning Specialist for inclusion into the Issues Log.

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1.10 CERTIFICATE OF READINESS

Prior to scheduling Functional Performance Tests for each system, issue a Certificate of Readiness for the system certifying that the system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, all equipment and system start-up reports; completed Building Envelope Inspection Checklists; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; HVAC Controls Start-Up Reports[; and the Air Leakage Test Reports and Diagnostic Test Reports] to the extent applicable to the system. The Contractor; the Lead Commissioning Specialist; the Contractor's Quality Control Representative; the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and date the Certificate of Readiness. Submit the Certificate of Readiness for each system no later than 14 calendar days prior to Functional Performance Tests of that system. Submit [one][_____] hard copy and an electronic copy to the Contracting Officer. Do not schedule Functional Performance Tests for a system until the Certificate of Readiness for that system receives approval by the Government.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 CONSTRUCTION PHASE

3.1.1 Construction Commissioning Coordination Meeting

The Lead Commissioning Specialist must lead a Construction Commissioning Coordination Meeting no later than 14 days after approval of the Commissioning Firm and Commissioning Specialists to discuss the commissioning process including contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics as specified in this specification section. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, and the Government must attend this meeting. Invite the User and , [_____] to attend this meeting.

[3.1.2 Design Phase Commissioning Plan

A commissioning plan developed during design phase is provided as Appendix C for information only. The design phase commissioning plan does not form a part of this contract and is provided for commissioning review purposes only.

]3.1.3 Construction Phase Commissioning Plan

3.1.3.1 Interim Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Interim

Construction Phase Commissioning Plan. Submit the Interim Construction Phase Commissioning Plan no later than 30 calendar days after the Construction Commissioning Coordination Meeting and no later than 14 days prior to the start of construction of the building envelope. Submit [one][_____] hard copy and an electronic copy.

Identify the commissioning and testing standards and outline the overall commissioning process, the commissioning schedule, the commissioning team members and responsibilities, lines of communication, documentation requirements for the construction phase of the project, and Template Building Envelope Inspection Checklists in the Interim Construction Phase Commissioning Plan.

3.1.3.1.1 Checklists

Download example Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists[, and Integrated Systems Test Checklists] for specification section 01 91 00.15 TOTAL BUILDING COMMISSIONING at the following location: http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf. The checklists submitted in the Interim and Final Construction Phase Commissioning Plans must contain the same level of detail shown in the examples. The submitted checklists are not required to match the format of the examples.

3.1.3.1.2 Template Building Envelope Inspection Checklists

The Building Envelope Technical Commissioning Specialist must develop the Template Building Envelope Inspection Checklists. Include items that verify the building materials and construction maintain the required thermal and moisture integrity and air tightness of the building envelope system in the Building Envelope Inspection Checklists.

3.1.3.2 Final Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Final Construction Phase Commissioning Plan. Submit the Final Construction Phase Commissioning Plan no later than 30 calendar days prior to the start of Pre-Functional Checks. Submit [one][_____] hard copy and an electronic copy.

Include the information provided in the Interim Construction Phase Commissioning Plan. In addition, the Technical Commissioning Specialist must develop the Pre-Functional Checklists, [Integrated Systems Test Checklists,] and Functional Performance Test Checklists for each building, for each system required to be commissioned, and for each component for inclusion in the Final Construction Phase Commissioning Plan.

3.1.3.2.1 Pre-Functional Checklists

The Pre-Functional Checklists must include items for physical inspection or testing that demonstrate that installation and start-up of equipment and systems is complete. See paragraph Pre-Functional Checks for more information. Functional Performance [and Integrated Systems Test] test procedures must explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract in the Functional Performance Test[and Integrated Systems Test] Checklists. See paragraph Functional Performance[and Integrated Systems] Tests for more information.

3.1.3.2.2 Functional Performance Test Checklists

Functional Performance Test Checklists must include procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. See paragraph Functional Performance[and Integrated Systems] Tests for more information. Include the following sections and details appropriate to the systems being tested in the Functional Performance Test Checklists:

a. Notable system features including information about controls to facilitate understanding of system operation

b. Conclusions and recommendations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements. Recommendation must clearly indicate that the system should or should not be accepted by the Government.

c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions

d. Attendees

e. Identification of the equipment involved in the test

f. Control system feature identification

g. Point-to-point observations including demonstrating system flow meters and sensors have been calibrated and are correctly displayed on the Operator work station

h. Actuator operation observations demonstrating actuator responses to commands from the control system

[3.1.3.2.3 Integrated Systems Test Checklists

Integrated Systems Test Checklists must include test procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. See paragraph Functional Performance[and Integrated Systems] Tests for more information. Include the following sections in the Integrated Systems Test Checklists:

a. Notable features of the interconnected systems organized by discipline including information to facilitate understanding of system operation

b. Conclusions and recommendations. Conclusions must clearly indicate if the systems do or do not perform in accordance with contract requirements. Recommendation must clearly indicate that the systems should or should not be accepted by the Government

c. Test conditions including date and beginning and ending time

d. Attendees

e. Identification of the equipment and systems involved in the test

][3.1.4 Design Review

The Lead Commissioning Specialist and Technical Commissioning Specialists

must review the construction contract plans and specifications, the Owner's Project Requirements, and the Basis of Design. The Owner's Project Requirements are attached as Appendix A. The Basis of Design is attached as Appendix B. The Owner's Project Requirements and Basis of Design documents are not contract documents and are provided for commissioning review purposes only.

a. Advise the of any discrepancies between the Basis of Design and Owner's Project Requirements, deficiencies of the design to comply with the Owner's Project Requirements or Basis of Design, and deficiencies that would prevent the building systems and features from operating or performing effectively and from being adequately maintainable.

b. The Commissioning Specialists must provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation or performance. Submit [one][_____] hard copy and an electronic copy of the report to the no later than 14 days after approval of the Commissioning Specialists.

c. The Lead Commissioning Specialist must participate in a meeting to discuss any items contained in the report no later than 14 calendar days after submission of the report.

]3.1.5 Construction Submittals

Provide all submittals associated with the systems to be commissioned, including shop drawings; equipment submittals; test plans, procedures, and reports; and resubmittal's to the Commissioning Specialists. The Technical Commissioning Specialist must review the submittals to the extent necessary verify that the equipment and system installation will comply with the contract requirements and the requirements of the Basis of Design and the Owner's Project Requirements.

3.1.6 Inspection and Testing

Demonstrate that all system components have been installed, that each control device and item of equipment operates, and that the systems operate and perform, including interactive operation between systems, in accordance with contract documents and the Owner's Project Requirements. Requirements in related specification sections are independent from the requirements of this section and do not satisfy any of the requirements specified in this specification section. Provide all materials, services, and labor required to perform the Pre-Functional Checks, Building Envelope Inspection[, Integrated Systems Tests,] and Functional Performance Tests.

3.1.6.1 Commissioning Team

Provide a commissioning representative for each sub-contractor associated with the systems to be commissioned. Each commissioning representative is responsible for coordination of their respective sub-contractor's execution of the commissioning activities and participation in the inspection and testing required by this specification section. The designers listed below are the designers of record for their respective systems. Substitutes must be approved by the .

3.1.6.1.1 Building Envelope Inspections Team

The following team members must participate in building envelope inspections:

Designation	Function
CxB	Building Envelope Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
BEC	Contractor's Building Envelope Commissioning Representative
[AD]	[Architectural Designer]

3.1.6.1.2 Mechanical System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of mechanical systems:

Designation	Function
CxM	Mechanical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative
IC	Contractor's Irrigation Commissioning Representative

3.1.6.1.3 Electrical System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of electrical systems:

Designation	Function
CxE	Mechanical System Technical Commissioning Specialist

Designation	Function
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
EC	Contractor's Electrical Commissioning Representative

3.1.6.1.4 [Mechanical] [_____] Systems Test Team

The following team members must participate in Functional Performance[, Seasonal,][and Integrated Systems] Testing of mechanical systems:

Designation	Function
CxM	Mechanical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative
IC	Contractor's Irrigation Commissioning Representative
[MD]	[Mechanical Designer]
[PD]	[Plumbing Designer]
[ID]	[Irrigation Designer]

[3.1.6.1.5 [Electrical] [_____] Systems Test Team

The following team members must participate in Functional Performance [and Integrated Systems]Testing of electrical systems:

Designation	Function
CxE	Mechanical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative

Designation	Function
CQC	Contractor's Quality Control Personnel
EC	Contractor's Electrical Commissioning Representative
[ED]	[Electrical Designer]

]3.1.6.1.6 Other Pre-Functioanl and Functional Performance Participants

The following may participate as team members during Pre-Functional Checks and Functional Performance Testing:

Designation	Function
[DPW]	[Directorate of Public Works Representative]
[BCE]	[Base Civil Engineer Office Representative]
[RSC]	[Reserve Support Command Representative]
[PWD]	[Public Works Division Representative]
User	Using Agent's Representative

3.1.6.2 Building Envelope Inspection

Document building envelope inspection by the commissioning team using the approved Template Building Envelope Inspection Checklists. Indicate commissioning team member inspection and acceptance of each Building Envelope Inspection Checklist item by initials at the time they are inspected and found to be in conformance with contract requirements. Inspect checklist items before they become hidden as construction progresses. .

a. Submit the completed and initialed Building Envelope Inspection Checklists no later than 7 calendar days after completion of inspection of all checklists items. Submit [one][_____] hard copy and an electronic copy.

b. The Building Envelope Technical Commissioning Specialist must make at least two site visits to the site to observe construction of the building envelope in-progress. On each visit, the Building Envelope Commissioning Specialist must review the Contractor's in-progress checklists to ensure that the commissioning team is inspecting the building envelope as required.

c. The Building Envelope Technical Commissioning Specialist must witness the building envelope pressure tests and diagnostic tests specified in Specification Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS. The Building Envelope Technical Commissioning Specialist must review the resulting reports and provide recommendations for correction of any deficiencies or further testing.

3.1.6.3 Pre-Functional Checks

Pre-Functional Checklists from the approved Final Construction Phase Commissioning Plan must be completed by the commissioning team. Complete one Pre-Functional Checklist for each individual item of equipment or system for each system required to be commissioned including, but not limited to, ductwork, piping, equipment, fixtures (lighting and plumbing), and controls. Indicate commissioning team member inspection and acceptance of each Pre-Functional Checklist item by initials. Acceptance of each Pre-Functional Checklist item by each team member indicates that item conforms to the construction contract requirements in their area of responsibility. Technical Commissioning Specialist acceptance of each Pre-Functional Checklist item indicates that each item has been installed correctly and in accordance with contract documents and the Owner's Project Requirements. Submit the completed and initialed Pre-Functional Checklists no later than 7 calendar days after completion of inspection of all checklists items for each system. Submit [one][_____] hard copy and an electronic copy. Include manufacturer start-up checklists associated with equipment with the submission of the Pre-Functional Checklists.

3.1.6.4 Tests

3.1.6.4.1 Functional Performance[and Integrated Systems] Tests

Schedule Functional Performance Tests for each system only after the Certificate of Readiness has been approved by the Government for the system. Correct all deficiencies identified through any prior review, inspection, or test activity before the start of Functional Performance Tests. [Perform Integrated Systems Tests only after the Functional Performance Tests for each associated system are completed with all deficiencies resolved and after the related Functional Performance Test Checklists have been signed by each commissioning team member.]

. Technical Commissioning Specialists must lead and document all Functional Performance Tests [and Integrated Systems Tests]for the systems to be commissioned with the Contractor and appropriate sub-contractors performing the Functional Performance Tests[and Integrated Systems Tests]. The representatives listed in the paragraph Commissioning Team must attend the tests. Abort Functional Performance Tests [or Integrated Systems Tests]when any required commissioning team member is not present for the test.

3.1.6.4.1.1 Checklist

Use the Functional Performance Test [and Integrated Systems Test]Checklists from the approved Final Construction Phase Commissioning Plan to guide the Functional Performance Tests[and Integrated Systems Tests]. Functional Performance Tests must be performed for each item of equipment and each system required to be commissioned and verify all sensor calibrations, control responses, safeties, interlocks, operating modes, sequences of operation, capacities, lighting levels, and all other performance requirements comply with construction contract regardless of the specific items listed within the Functional Performance Test [and Integrated Systems Test] Checklists provided. Testing must progress from equipment or components to subsystems to systems to interlocks and connections between systems. [Integrated Systems Tests must be performed for the interactive operation between systems such as HVAC systems, fire protection systems, back-up electrical supply, energy generation systems, and other systems, and verify correct interactive operation, acceptable

speed of response, and other contract requirements for both normal and failure modes. Examples of Integrated Systems Tests include the correct operation of HVAC systems during emergency system activation, correct operation of uninterruptible power supplies or energy generators and connected systems, or lighting system operation during power outage or emergency system activation.]The order of components and systems to be tested must be determined by the Technical Commissioning Specialists.

3.1.6.4.1.2 Acceptance

Indicate acceptance of each item of equipment and systems tested by signature of each commissioning team member for each Functional Performance Test [or Integrated Systems Test Checklist]. The Contractor's Quality Control Representative and the Technical Commissioning Specialists must indicate acceptance after the equipment and systems are free of deficiencies.

3.1.6.4.2 HVAC Test Methods

Perform Functional Performance Tests in accordance with the following:

3.1.6.4.2.1 Prior to Testing

3.1.6.4.2.2 Simulating Conditions

Over-writing control input values through the controls system is not acceptable, unless approved by the . Identify proposed exceptions in a protocol submitted to the for approval. Before simulating conditions, overwriting values (if approved), or changing set-points, calibrate all sensors, transducers and devices. Below are several examples of exceptions that would be considered acceptable:

a. When varying static pressures inside ductwork can not be simulated within the duct, and where a sensor signals the controls system to initiate sequences at various duct static pressures, it is acceptable to simulate the various pressures with a Pneumatic Squeeze-Bulb Type Signaling Device with gauge temporarily attached to the sensing tube leading to the transmitter. It is not acceptable to reset the various set-points, nor to simulate an electric analog signal (unless approved as noted above).

b. Dirty filter pressure drops can be simulated using sheets of cardboard at filter face.

c. Freeze-stat safeties can be simulated by packing portion of sensor with ice.

d. High outside air temperatures can be simulated with a hair blower.

e. High entering cooling coil temperatures can be used to simulate entering cooling coil conditions.

f. Do not use signal generators to simulate sensor signals unless approved by the , as noted above, for special cases.

g. Control set points can be altered. For example, to see the air conditioning compressor lockout work at an outside air temperature

below 55 degrees F, when the outside air temperature is above 55 degrees F, temporarily change the lockout set point to be 0 degrees F above the current outside air temperature. Caution: Set points are not to be raised or lowered to a point such that damage to the components, systems, or the building structure and/or contents will occur.

h. Test duct mounted smoke detectors in accordance with the manufacturer's recommendations. Perform the tests with air system at minimum airflow condition in ductwork.

i. Test current sensing relays used for fan and pump status signals to control system to indicate unit failure and run status by resetting the set point on the relay to simulate a lost belt or unit failure while the unit is running. Confirm that the failure alarm was generated and received at the control system. After the test is conducted, return the set point to its original set-point or a set-point as indicated by the .

3.1.6.4.2.3 Setup

Perform each test under conditions that simulate actual conditions as close as is practically possible. Provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures, and other conditions necessary to execute the test according to the specified conditions. At completion of the test, return the affected building equipment and systems to their pre-test condition.

3.1.6.4.3 Sample Strategy

[Perform Functional Performance Tests using the following sample strategy. Prepare and complete a Functional Performance Test Checklist for each item of equipment or system to be tested. For sample sizes less than 100 percent for all similar equipment, the Government will select the specific equipment or system to be tested during testing. Equipment Identifiers are as indicated on the design drawings:

Equipment Identifier	Sample Size (Percent)
AHU	[_____]
VAV	[_____]
CUH	[_____]
CWP	[_____]
DWH	[_____]
Lighting Controls	[_____]
Renewable Energy Systems/Equipment	[_____]

[Perform Integrated Systems Tests for all systems and equipment having interactive operation.]]

3.1.6.4.4 Seasonal Tests

3.1.6.4.4.1 Initial Functional Performance Tests

Perform Initial Functional Performance Tests as soon as all contract work is completed, regardless of the season. Develop and implement means of artificial loading to demonstrate, to a reasonable level of confidence, the ability of the HVAC systems to handle peak seasonal loads.

3.1.6.4.4.2 Full-Load Conditions

In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems under full-load conditions during peak heating and cooling seasons during outdoor air condition design extremes. [Test cooling equipment and systems with the building fully occupied when performing the Functional Performance Tests during peak cooling season.]

Schedule Seasonal Functional Performance Tests in coordination with the Government.

3.1.6.4.4.3 System Acceptance

Systems may be partially accepted prior to seasonal testing if they comply with all construction contract that can be tested during initial Functional Performance Tests. All Functional Performance Test procedures must be completed prior to full systems acceptance.

3.1.6.4.5 Re-Testing

3.1.6.4.5.1 100 Percent Sample

Systems or equipment for which 100 percent sample size are tested fail if one or more of the test procedures results in discovery of a deficiency and the deficiency cannot be resolved within 5 minutes during the test.

Re-test to the extent necessary to confirm that the deficiencies have been corrected without negatively impacting the performance of the rest of the system.

3.1.6.4.5.2 Less than 100 Percent Sample

For systems tests with a sample size less than 100 percent, if one or more of the test procedures for an item of equipment or a system results in discovery of a deficiency, regardless of whether the deficiency is corrected during the sample tests, the item of equipment or system fails the test.

a. If the system failure rate is 5 percent or less, meaning that 5 percent or less of the equipment or systems had at least one deficiency, re-test only on the items which experienced the initial failures.

b. If the system failure rate is higher than 5 percent, meaning that more than 5 percent of equipment or systems tested had at least one deficiency, re-test the items which experienced the initial failures to the extent necessary to confirm that the deficiencies have been corrected . In addition, test another random sample of the same size as the initial sample for the first time. If the second random sample

set has any failures, re-test those failed items and all remaining equipment and systems to complete 100 percent testing of that system type.

3.1.7 Training Plan

all training required by specification sections associated with commissioned systems. Include a matrix listing each training requirement, content of the training, the trainer name, trainer contact information, and schedule and location of training. Submit [one][_____] hard copy and an electronic copy of the Training Plan to the Commissioning Specialists and the Government no later than [30][_____] calendar days prior to the associated training.

Document training attendance using training attendance rosters and provide completed attendance rosters to the Commissioning Specialists and the Government no later than 7 calendar days following the completion of training for each system to be commissioned. Submit [one][_____] hard copy and an electronic copy..

3.1.8 Systems Manual

[Systems Manual][Computerized Maintenance Management System Manual] including, for all commissioned systems, the Basis of Design, system single line diagrams, as-built sequences of operation and controls drawings, as-built control setpoints, recommended schedule for sensor and actuator calibration, recommended schedule of maintenance when not in the O&M manuals, recommended re-testing schedule with proposed testing forms, and full equipment warranty information. Update and resubmit the Systems Manual based on any corrective action taken during the warranty period.

Submit [Systems Manual][Computerized Maintenance Management System Manual] no later than 30 calendar days following completion of Functional Performance Tests. Submit [three][_____] hard copies and an electronic copy.

3.2 COMMISSIONING REPORT

Following the completion of Functional Performance Tests[and Integrated Systems Tests], with the exception of Seasonal Tests, the Lead Commissioning Specialist must prepare a Commissioning Report.

a. Include an executive summary describing the overall commissioning process, the results of the commissioning process, any outstanding deficiencies and recommended resolutions, and any seasonal testing that must be scheduled for a later date. Indicate, in the executive summary, whether the systems meet the requirements of the construction contract and the Owner's Project Requirements.

b. Detail any deficiencies discovered during the commissioning process and the corrective actions taken in the report. Include the completed [Building Envelope Inspection Checklists,]Pre-Functional Checklists, Functional Performance Test Checklists, [Integrated Systems Test Checklists,]the Commissioning Plans, the Issues Log, Training Attendance Rosters, the Design Review Report, the final TAB Report.

c. Submit the Commissioning Report no later than 14 calendar days following commissioning team acceptance of all Functional Performance Tests [and Integrated Systems Tests]with the exception of Seasonal

Tests. Submit [three][_____] hard copies and an electronic copy.

d. Following any Seasonal Tests or Post-Construction Activities, update the Final Commissioning Report to reflect any changes and resubmit.

[3.3 POST-CONSTRUCTION SUPPORT

3.3.1 Post-Construction Endurance Test

[Perform an Endurance Test in accordance with the paragraph Endurance Test in Specification Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC once during the peak heating season and once during the peak cooling season during outdoor air condition extremes with the exception that network bandwidth usage measurement and recording is not required. [Use the Temporary Trending Hardware, if necessary, in accordance with Specification Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC.]] [Perform a [one-week] [_____] Endurance Test once during the peak heating season and once during the peak cooling season during outdoor air condition extremes using the building control system to trend all points shown as requiring a trend on the project schedules. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost. Poll all points shown in the project schedules with an alarm condition at 5 minute intervals. Poll all points shown in the project schedules required for trending, overrides, or graphical displays at 15 minute intervals.]

The Mechanical System Commissioning Specialists must review the trend logs from the Endurance Tests to ensure that the systems have stable operation and operate as required by the construction contract, and the Owner's Project Requirements. The Commissioning Specialists must provide a Post-Construction Trend Log Report that identifies any deficiencies noted in operation and includes a graphical representation of the trends. Provide one Trend Log Report for the peak cooling season and one Trend Log Report for the peak heating season. Submit [one][_____] hard copy and one electronic copy of the Post-Construction Trend Log Reports no later than 14 calendar days following receipt of the trend log data by the Commissioning Specialist.

3.3.2 Post-Construction Site Visit

[The Commissioning Specialists must visit the building site [concurrent with the 9 month warranty inspection][_____] to inspect building system equipment and review building operation with the building operating/maintenance staff. The Commissioning Specialists must identify any deficiency of the building systems to operate in accordance with the contract requirements and the Owner's Project Requirements. The Commissioning Specialists must advise the of any identified deficiencies and the proposed corrective action. Submit an updated commissioning report and systems manual documenting the results of the post-construction inspection.]

]

APPENDIX A - OWNER'S PROJECT REQUIREMENTS

OWNER'S PROJECT REQUIREMENTS DOCUMENT

Project: Project, Location, PN #####

Approved:

Name	Design Agent's Representative	Date
Name	Owner's Representative	Date

OWNER'S PROJECT REQUIREMENTS DOCUMENT

Contents

Contents (continued)

d. On-site Power Systems
    i. Quality and Reliability
    ii. Type
    iii. Automation
    iv. Flexibility
    v. Maintenance Requirements
e. Other Systems
    i. Quality and Reliability
    ii. Type
    iii. Automation
    iv. Flexibility
    v. Maintenance Requirements

6. Building Occupant and O&M Personnel Requirements
   a. Facility Operation
   b. UMCS (EMCS or FMCS)
   c. Occupant Training and Orientation
   d. O&M Staff Training and Orientation

1. Owner and User Requirements

a. Primary Purpose, Program, and Use

Explain the purpose, program, and use of the facility. (i.e. Army Reserve Center used for training reserve units. Training includes spaces such as weapons, medical, vehicle repair, cooking, etc.)

b. Project History

Explain the history of the project related to design/construction (i.e. D/B/B, D/B, IDIQ, JOC, COE in-house, A/E, etc.). Explain any additional project background that would impact energy/sustainability goals.

c. Broad Goals

i. Future Expansion: Explain goals related to potential future expansion.

ii. Flexibility: Explain goals related to flexibility for layout and use of the building. (i.e. high rate of office churn, expected frequency of renovation, etc.)

iii. Quality of Materials: Explain goals related to quality of materials. (i.e. highest quality materials, 50 yr life, 25 yr life, highest quality within budget, etc.)

iv. Construction Costs: Explain goals related to construction costs. (i.e. how low can you go, set project amount, select simplest systems for low cost, etc.)

v. Operational Costs: Explain goals related to operational costs. (i.e. low utilities based on water and energy conservation, trade-off allowable on maintenance costs to reduce utility cost, utility cost unimportant compared to construction cost, etc.)

2. Environmental and Sustainability Goals

a. LEED/Green Globes Goal

Set LEED/Green Globes goal and explain sustainable features permissible or preferred to be incorporated. Explain relative importance of LEED/Green Globes goal within project scope. Indicate requirement from service or agency specific criteria and policy.

b. Other

Explain any special sustainability or environmental goals associated with the project. Identify specific sustainability features that may be required or desired. (i.e. hydro-power, solar power, on-site water treatment, on-site water infiltration, impervious cover reduction, parking capacity, etc.)

3. Energy Efficiency Goals

a. Goals/Policy

Explain the specific project goals and requirements regarding energy efficiency. Incorporate the requirements of UFC 1-200-02 High Performance and Sustainable Building Requirements and/or other relevant agency policies.

b. Systems and Feature Energy Impacts

Identify and explain envelope, system, or site and building features that will be incorporated to maximize energy efficiency. Identify features that must be incorporated that will reduce or limit energy efficiency.

4. Indoor Environmental Quality Requirements

a. Space Type 1

i. Intended Use: Explain how the space will be used (i.e. classroom occasionally used as conference room).

ii. Occupancy Schedule: Describe the occupancy including number of people at various times (i.e. drill weekend-maximum capacity, weekdays-20 percent; or 0700-0900 - none, 0900-1400 - 30 people, 1400-1600 - none).

iii. Environmental Requirements: Describe the environmental requirements of the space. Include description of temperatures, humidity levels, ventilation rates, air quality, lighting levels, or any other specific parameters desired (i.e. 75 deg F, 50 percent rh, 30 fc, etc.).

iv. Occupant System Control Ability: Describe the desired level of control the occupants will have over the thermal comfort and lighting systems. (i.e. adjustable thermostat for every person, adjustable thermostat in all private offices, no adjustable thermostats, adjustable thermostat in senior rank also controlling other offices, occupancy sensors for lighting, adjustable dimming, etc.)

v. Type of Lighting: Describe the type of lighting desired (i.e. task lighting with minimal overhead, maximize daylight with dimming on overhead, accent lighting, particular fixtures, etc.).

vi. After-hour Use Accommodations: Describe whether and how often the space may be used after hours. Describe the systems that activate when an occupant uses the building after-hours. Describe the level of control of after-hour use HVAC.

(Example: Space is rarely used after-hours by few occupants. HVAC and lighting system should activate when occupants enter after-hours. The HVAC operation will be limited to that required to provide heating, A/C, and ventilation to the occupied space alone.) (Example: Space is rarely used after-hours by few occupants. Lighting and heating systems should activate. Ventilation and cooling should remain in normal after-hour operation.)

b. Space Type 2

5. Equipment and System Expectations

a. HVAC Systems

i. Quality and Reliability: Explain the level of quality and reliability required of the HVAC systems.

(Example: Equipment efficiency should meet ASHRAE [_____] and FEMP/Energy Star requirements. Due to critical nature of facility, additional redundancy in the cooling and heating systems is required, i.e. multiple chillers, boilers, and pumps.) (Example: No specific quality or reliability requirements specified. Equipment should remain serviceable over life of building or to the extent typical of the type of equipment.)

ii. Type: Explain the type of equipment desired.

(Example: Boilers should be condensing type. Use hydronic heating and cooling. Use self-contained A/C units in computer rooms.)

iii. Automation: Explain the level of automation in the HVAC System desired.

(Example: Single loop HVAC systems permissible. Use packaged controls only.) (Example: Control HVAC systems from DDC system connected to the base UMCS.) (Example: Boilers should have packaged controls connected to the DDC system.)

iv. Flexibility: Describe the desired level of flexibility of the HVAC system.

(Example: System should accommodate frequent office layout changes including private office wall movement.) (Example: Layout will remain mostly unchanged; no flexibility required.) (Example: Accommodate potential for conference and classrooms to change to offices.)

v. Maintenance Requirements: Describe the level of maintenance available or the requirements of the equipment regarding maintainability.

(Example: Equipment should be located to allow easy maintenance access. Equipment vendors or repair service should be able to respond within 24 hrs.)

b. Lighting Systems

i. Quality and Reliability: Explain the level of quality and reliability required of the lighting system controls.

(Example: The building lighting system should meet ASHRAE 90.1 - IP requirements.)

ii. Type: Explain the type of lighting or control equipment desired.

(Example: High-efficiency fluorescent lamps with high-efficiency ballasts will be specified. Indirect lighting will be used in all office and classroom spaces. Lighting foot-candle levels may be reduced to 45 foot-candles in lieu of the typical 50 foot-candles when indirect lighting is used.)

iii. Automation: Explain the level of automation in the lighting control

system desired.

(Example: Provide occupancy sensors in restrooms, corridors, and storage areas.)

iv. Flexibility: Describe the desired level of flexibility of the lighting system and control systems.

(Example: Provide dual level switching in classrooms and conference rooms.)

v. Maintenance Requirements: Describe the level of maintenance available or the requirements of the equipment regarding maintainability.

(Example:)

c. Domestic Hot Water Systems

i. Quality and Reliability: Explain the level of quality and reliability required of the domestic hot water systems.

(Example: Equipment efficiency should meet ASHRAE and FEMP/Energy Star requirements. Due to critical nature of facility, additional redundancy in the water heating systems is required, i.e. multiple hot water heaters and circulation pumps.) (Example: No specific quality or reliability requirements specified. Equipment should remain serviceable over life of building or to the extent typical of the type of equipment.)

ii. Type: Explain the type of equipment desired.

(Example: Gas-fired storage tank water heater with mixing valve for temperature control.) (Example: Instantaneous electric water heater at lavatories.) (Example: Instantaneous electric water heater with integral control system for eyewash/showers.)

iii. Automation: Explain the level of automation in the domestic hot water control system desired.

(Example: Occupancy schedule control for recirculation loop and gas burner. Connect package controls to DDC system.)

iv. Flexibility: Describe the desired level of flexibility of the domestic hot water systems.

(Example: No anticipated changes to restroom layout; no additional flexibility required.)

v. Maintenance Requirements: Describe the level of maintenance available or the requirements of the equipment regarding maintainability.

(Example: Equipment should be located to allow easy maintenance access. Equipment vendors or repair service should be able to respond within 24 hrs.)

d. On-site Power Systems

i. Quality and Reliability: Explain the level of quality and reliability required of the on-site power system.

ii. Type: Explain the type of on-site power system desired.

iii. Automation: Explain the level of automation in the on-site power system desired.

iv. Flexibility: Describe the desired level of flexibility of the on-site power system.

v. Maintenance Requirements: Describe the level of maintenance available or the requirements of the on-site power system regarding maintainability.

e. Other Systems

i. Quality and Reliability: Explain the level of quality and reliability required of the system.

ii. Type: Explain the type of system desired.

iii. Automation: Explain the level of automation in the system desired.

iv. Flexibility: Describe the desired level of flexibility of the system.

v. Maintenance Requirements: Describe the level of maintenance available or the requirements of the system regarding maintainability.

6. Building Occupant and O&M Personnel Requirements

a. Facility Operation

Describe how the facility will be operated. Who operates the facility? Who maintains the facility? Who pays the utility bills?

b. UMCS (EMCS or FMCS)

Will the building be tied to an UMCS/EMCS/FMCS? What system will be connected to? Provide information regarding connection requirements, protocols, and control, scheduling and monitoring points.

c. Occupant Training and Orientation

How much training and orientation is desired for building occupants? Will training need to be provided for all systems? To what extent do the occupants need to understand and use the systems?

d. O&M Staff Training and Orientation

How much training and orientation is desired for building occupants? Will training need to be provided for all systems? To what extent do the occupants need to understand and use the systems?

APPENDIX B - BASIS OF DESIGN

APPENDIX C - DESIGN PHASE COMMISSIONING PLAN

-- End of Section --

SECTION 33 52 43.13

AVIATION FUEL PIPING
08/18, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 1110	(2013; R 2018) Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide
API STD 600	(2015) Steel Gate Valves-Flanged and Butt-welding Ends, Bolted Bonnets
API STD 608	(2012) Metal Ball Valves - Flanged, Threaded, And Welding End
API Spec 5L	(2018; 46th Ed; ERTA 2018) Line Pipe
API Spec 6D	(June 2018, 4th Ed; Errata 1 July 2018; Errata 2 August 2018) Specification for Pipeline and Piping Valves
API Spec 6FA	(1999; R 2006; Errata 2006; Errata 2008; R 2011) Specification for Fire Test for Valves
API Std 594	(2017) Check Valves: Flanged, Lug, Wafer and Butt-Welding
API Std 607	(2016) Fire Test for Quarter-turn Valves and Valves Equipped with Non-metallic Seats
API Std 609	(2016; ERTA 2017) Butterfly Valves: Double Flanged, Lug-and-Wafer Type

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1	(2003; R 2018) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings

ASME B16.11	(2016) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.3	(2020) Process Piping
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C209	(2019) Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipelines
AWWA C215	(2016) Extruded Polyolefin Coatings for Steel Water Pipe

AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M	(2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.5/A5.5M	(2014) Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
AWS A5.9/A5.9M	(2017) Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A105/A105M	(2021) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A182/A182M	(2021) Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting

	Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2022) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A234/A234M	(2019) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A269/A269M	(2015; R 2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A312/A312M	(2021) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A358/A358M	(2019) Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications
ASTM A403/A403M	(2022) Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A564/A564M	(2019) Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A960/A960M	(2018a) Standard Specification for Common Requirements for Wrought Steel Pipe Fittings
ASTM A961/A961M	(2021) Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications
ASTM D229	(2019) Standard Test Methods for Rigid Sheet and Plate Materials Used for Electrical Insulation
ASTM F436	(2011) Hardened Steel Washers

BRITISH STANDARDS INSTITUTE (BSI)

BS EN ISO 10497	(2010) Testing of Valves Fire Type-Testing Requirements

ENERGY INSTITUTE (EI)

EI 1529	(2014; 7th Ed) Aviation Fueling Hose and Hose Assemblies

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2021; TIA 20-1; TIA 20-2) Flammable and Combustible Liquids Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 1	(2015) Solvent Cleaning

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AS5877	(2016; Rev B) Detailed Specification for Aircraft Pressure Refueling Nozzle
SAE J514	(2012) Hydraulic Tube Fittings

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-25896	(1983; Rev E; Notice 1 1989; Notice 3 2003) Adapter, Pressure Fuel Servicing, Nominal 2.5 inch diameter
MIL-PRF-4556	(1998; Rev F; Am 1 1999; CANC Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks
MIL-PRF-13789	(1999; Rev E; Notice 1 2008; Notice 2 1016; Notice 3 2021) Strainers, Sediment: Pipeline, Basket Type
MIL-STD-161	(2005; Rev G; Notice 1 2010) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

1.2 ADMINISTRATIVE REQUIREMENTS

Design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT. Submit Operation and Maintenance Manuals for the equipment items or systems listed below. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the

information to be submitted for various type of equipment and systems.

Manual Valves
Flexible Ball Joints
Surge Suppressor Tank and Valve
Strainers
Protective Coatings
Sample Connections
Isolating Gasket Kits
Gaskets
Flexible Hoses
Top Loading Arms

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Qualifications; G[, [_____]]

SD-03 Product Data

Carbon Steel Piping; G[, [_____]]

Stainless Steel Piping; G[, [_____]]

Protective Coatings for Buried Stainless Steel Piping; G[, [_____]]

Fittings; G[, [_____]]

Isolating Gasket Kits; G[, [_____]]

Flange Protectors; G[, [_____]]

Lightning Surge Arrester; G[, [_____]]

Nuts and Bolts; G[, [_____]]

Gaskets; G[, [_____]].

Ball Valves; G[, [_____]].

Plug (Double Block and Bleed) Valves; G[, [_____]].

Swing Check Valves; G[, [_____]].

Silent Check Valves; G[, [_____]].

Butterfly Valve with Fusible Link Operator; G[, [_____]].

Relief Valves; G[, [_____]].

Flexible Ball Joints; G[, [_____]]

Strainers; G[, [_____]]

Sample Connections; G[, [_____]]

Flanged Swivel Joints; G[, [_____]]

Fuel Hose; G[, [_____]]

Nozzle Adapter (SPR); G[, [_____]]

Pigging Accessories; G[, [_____]]

Flexible Hoses; G[, [_____]]

Top Loading Arms; G[, [_____]]

Automatic Air Vent; G[, [_____]]

Surge Suppressor Tank and Valve; G[, [_____]]

SD-05 Design Data

Pipeline Inventory; G[, [_____]]

SD-06 Test Reports

Pneumatic Test

Hydrostatic Test

Geometry/Ultrasonic Tool Reports; G[, [_____]]

SD-07 Certificates

Carbon Steel Piping

Stainless Steel Piping

Protective Coatings for Buried Stainless Steel Piping

Fittings

Isolating Gasket Kits

Lightning Surge Arrester

Nuts and Bolts

Gaskets

Ball Valves

Plug (Double Block and Bleed) Valves

Swing Check Valves

Silent Check Valves

Butterfly Valve with Fusible Link Operator

Relief Valves.

Flexible Ball Joints

Strainers

Sample Connections

Flanged Swivel Joints

Fuel Hose

Nozzle Adapter (SPR)

Pigging Accessories

Flexible Hoses

Automatic Air Vent

Surge Suppressor Tank and Valve

Survey Final Elevations

Pipeline Pigging Verification; G[, [_____]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]]

1.4 QUALITY ASSURANCE

1.4.1 Design Data

1.4.1.1 Pipeline Inventory

Fuel system volume must be calculated using as constructed pipe lengths, internal diameters, fittings, and components. Totals must be provided for all items containing fuel with the exception of tanks which is covered by other specifications. A detailed list with sizes, lengths, quantity, and volumes must be provided for pumphouse, hydrant loop, etc.

1.4.2 Contractor Qualifications

Each installation Contractor must have successfully completed at least 3 projects of the similar scope and the same size or larger within the last 6 years. Each installation Contractor must demonstrate specific installation experience in regard to the specific system installation to be performed. Each installation Contractor must have taken, if applicable, manufacturer's training courses on the installation of piping and must meet the licensing requirements in the state. Submit a letter listing prior projects, the date of construction, a point of contact for each prior project, the scope of work of each prior project, and a detailed list of work performed. Provide in the letter evidence of prior manufacturer's training and state licensing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Pipe and fittings in contact with fuel must be stainless steel, interior epoxy coated carbon steel, or carbon steel as indicated on the drawings. No zinc coated metals, brass, bronze or other copper bearing alloys must be used in contact with the fuel. All carbon steel and stainless steel underground piping must have an exterior protective coating and must be cathodically protected in accordance with Section 26 42 17 IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) SYSTEM. Identification of piping must be in accordance with MIL-STD-161 unless specified otherwise. Material for manual valves must be as specified hereinafter.

2.1.1 Carbon Steel Piping

Subject each length of pipe to factory hydrostatic testing and ultrasonic testing in accordance with their respective pipe specification.

a. Piping 12-Inches and Larger: Seamless, ASTM A53/A53M Grade B having a wall thickness of 0.375-inch.

b. Piping 2 1/2 through 10-Inches: Seamless, Schedule 40 API Spec 5L Grade B or ASTM A53/A53M Grade B.

c. Piping 2-Inches and Smaller: Seamless, Schedule 80 API Spec 5L Grade B or ASTM A53/A53M Grade B.

d. Welding Electrodes (Factory Fabrication): E70XX low hydrogen electrodes conforming to AWS A5.1/A5.1M or AWS A5.5/A5.5M.

e. Internal Pipe Coating (Epoxy Lining) for piping 3.5 inches and larger must be fusion bonded epoxy coated in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM. The ends of the pipe must be masked or wiped back a minimum of one inch but not more than 1-1/2 inches.

2.1.2 Stainless Steel Piping

a. Piping 2-1/2-Inches and Larger:

(1) ASTM A358/A358M, Grade 304L, Class 1 or Class 3 with supplementary requirements of S1, S2 and S3, or ASTM A312/A312M Type 304L, seamless (only). Any agreements between the purchaser and the manufacturer or supplier as referenced in the applicable ASTM must include the Contracting Officer as a party to the agreement. All piping welds will receive 100 percent radiographic inspection, 100 percent liquid penetrant inspection, 100 percent visual inspection and all tests as required by the applicable ASTM Standard. Piping must be provided with a nominal wall thickness as shown in Table A for ASTM A358/A358M with the deviation from the nominal wall thickness less than 0.01-inch. ASTM A312/A312M seamless piping must be provided with a minimum schedule 10S wall thickness.

TABLE A		
Nominal Pipe Size	Nominal (Average) Pipe O.D.	Wall Thickness(tn)
16 inches	16.000 inches	0.312 inch
14 inches	14.000 inches	0.312 inch
12 inches	12.750 inches	0.250 inch
10 inches	10.750 inches	0.250 inch
8 inches	8.625 inches	0.250 inch
6 inches	6.625 inches	0.219 inch
4 inches	4.500 inches	0.219 inch
2.5 inches	2.875 inches	0.156 inch

(2) Pipe Ends: All Piping must be provided with beveled ends per Chapter V, ASME B31.3, and must be shipped with the ends capped.

(3) Factory Testing and Inspection Records: Per Table K341.3.2 of Chapter IX of ASME B31.3, visual, radiographic and liquid penetrant tests must be performed for each section of piping provided as all sections are subjected to cyclic conditions. All testing and inspections records must be submitted to the Contracting Officer and must indicate the pipe mark and installed location of each piping section on the project site. Observation by the Contracting Officer of the manufacturers and the fields testing and inspection procedures must be allowed under this contract. Pipe certification along with pipe markings must be submitted before the pipe arrives on the job site.

(4) Provide a qualified inspector in accordance with Chapter VI of ASME B31.3. to act as the owner's inspector (for the Government) at the pipe manufacturer's facility in addition to the manufacturer's inspector.

(5) Submit Quality Assurance Plan for the welding, inspecting and testing of the welded seam pipe.

b. Piping 2-inches and Smaller: Schedule 80 ASTM A312/A312M seamless Type 304L for threaded piping and schedule 40 (unless otherwise indicated) ASTM A312/A312M seamless Type 304L for welded piping.

c. Stainless Steel Control Tubing: Seamless, fully annealed tubing conforming to ASTM A269/A269M, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.049-inch.

d. Welding Electrodes (Factory Fabrication): E308L conforming to AWS A5.9/A5.9M.

2.1.3 Protective Coatings for Aboveground Piping

Provide coating of aboveground piping, piping in pits, pipe supports, filter separators, and miscellaneous metal and equipment in accordance with Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES. Color of finish coat must be [white][beige]. Do not paint stainless steel or aluminum surfaces.

2.1.4 External Protective Coatings for Buried Steel Piping

2.1.4.1 Protective Coatings for Buried Carbon Steel Piping

a. New pipe and fittings must be factory coated fusion bonded epoxy (FBE) in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

b. Field joints and repairs must be fusion bonded epoxy (FBE) in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

c. Field joints and repairs in tight spots (valve pits, etc. when heaters are too big) must be liquid epoxy in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

d. Existing systems must match existing coating system and must be in accordance with Section 33 52 80 LIQUID FUELS PIPELINE COATING SYSTEM.

[e. Abrasion-resistant topcoat. Following the initial FBE coating application, provide a 20 mil thick abrasion-resistant FBE topcoat. Abrasion-resistant topcoat must be specifically suited for directional boring piping installation.

]2.1.4.2 Protective Coatings for Buried Stainless Steel Piping

Provide pipe with AWWA C215 Type B coating system of factory-applied adhesive undercoat and continuously extruded plastic resin coating; minimum thickness of plastic resin must be 36 mils for pipe sizes 6 inches and larger. Surface preparation must follow SSPC SP 1. Adhesion to steel substrate test must be a minimum of 5 lb/in. Cathodic disbondment test is not required. Fittings, couplings, irregular surfaces, damaged areas of pipe coating, and existing piping affected by the Contractor's operations must be clean, dry, grease free, and primed before application of tape. Tape must overlap the pipe coating not less than 3 inches . Waterproof shrink sleeves may be provided in lieu of tape and must overlap the pipe coating not less than 6 inches . Pipe coating and adhesive undercoat surfaces to be wrapped with tape must be primed with a compatible primer prior to application of tape. Primer must be as recommended by tape manufacturer and approved by pipe coating manufacturer.

a. Damaged Areas of Pipe Coating: Provide AWWA C209, 20 mils nominal thickness of tape over damaged areas. Residual material from damaged areas of pipe coating must be pressed into the break or trimmed off. Apply tape spirally with one-third overlap as tape is applied. A double wrap of one full width of tape must be applied at right angles to the axis to seal each end of the spiral wrapping.

b. Fittings, Couplings, and Regular Surfaces: Provide AWWA C209, 10 mils nominal thickness tape overlapped not less than 1.0 inch over damaged areas. Initially stretch and apply first layer of tape to conform to component's surface. Then apply and press a second layer of tape over first layer of tape.

c. Testing of Protective Coatings: Perform tests with an approved silicone rubber electric wire brush or an approved electric spring coil flaw tester. Tester must be equipped with an operating bell, buzzer, or other audible signal which will sound when a holiday is detected at minimum testing voltage equal to 6,275 times the square root of the average coating thickness in mils. Tester must be a type so fixed that field adjustment cannot be made. Calibration by tester manufacturer must be required at six-month intervals or at such time as crest voltage is questionable. Certify in writing the calibration date and crest voltage setting. Maintain the battery at ample charge to produce the crest voltage during tests. Areas where arcing occurs must be repaired by using material identical to original coating or coating used for field joints. After installation, retest the exterior surfaces, including field joints, for holidays. Promptly repair holidays.

2.1.5 Fittings

2.1.5.1 General

Welding ells, caps, tees, reducers, etc., must be of materials compatible for welding to the pipe line in which they are installed, and wall thickness, pressure and temperature ratings of the fittings must be not less than the adjoining pipe line. Unless otherwise required by the conditions of installation, all elbows must be the long radius type. Miter joints are not acceptable. Make odd angle offsets with pipe bends or elbows cut to the proper angle. Butt weld fittings must be factory-made wrought fittings manufactured by forging or shaping. Fabricated fittings will not be permitted. Welding branch fittings must be insert type suitable for radiographic inspections specified herein, unless indicated otherwise on the drawings.

2.1.5.2 Carbon Steel Fittings

a. Fittings 2.5 Inches and Larger: Butt weld, conforming to ASTM A234/A234M, grade WPB and ASME B16.9 of the same wall thickness as the adjoining pipe. All welds must be radiographically examined throughout the entire length of each weld. Each fitting must be subjected to the Supplementary Requirements S52 and S53, Liquid Penetration examination and Magnetic-Particle Examination per ASTM A960/A960M. Detectable flaws will not be accepted in the supplementary examinations. Fittings must be identified to relate them to their respective radiograph. Elbows located between the pig launcher and the receiver, must have a radius 1.5 times the pipe diameter. Tees with branches 6-inches and larger, must have guide bars as detailed on the drawings.

b. Fittings 2 Inches and Smaller. Forged (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G., conforming to ASTM A105/A105M, Grade 2 and ASME B16.11. Threaded fittings must only be used for above grade applications. Underground and in pits low point drain pipe and high point vent pipe must be butt welded.

c. Flanges: 150 pound weld neck, forged flanges conforming to ASTM A105/A105M, and ASME B16.5. For flanges 2" and smaller located in contained pumphouses, contained truck offloads, contained truck fill stands, and other visibly contained areas the fitting may be

forged (socket welded), 900 kg 2,000-pound W.O.G., conforming to ASTM A105/A105M, Grade 2 and ASME B16.11. In pits, vaults, on PRV piping for pipeline routes, and other uncontained locations the connection must be butt welded. Flanges to be 1/16-inch raised face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flange face must be machined to match valves or equipment furnished. Use of spacing rings or gaskets discs are not allowed. Flanges must be subjected to the Supplementary Requirements S56, Liquid Penetrant Examination as outlined in ASTM A961/A961M. Detectable flaws will not be accepted.

d. Interior Epoxy Coating System must be applied to the fittings as specified in paragraph "Carbon Steel Piping."

2.1.5.3 Stainless Steel Fittings

a. Fittings 2.5 Inches and Larger: Butt weld stainless steel conforming to ASTM A403/A403M, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same minimum wall thickness as the adjoining pipe. Welded fittings must be tested and inspected the same as the welded seam pipe and meet the same requirements as for the pipe. Elbows located between the pig launcher and the receiver, must have a radius 1.5 times the pipe diameter. Tees with branches 6-inches and larger, must have guide bars as detailed on the drawings.

b. Fittings 2-Inches and Smaller: Forged Type 304 or 304L (socket welded or if indicated on drawings, threaded), 2,000-pound W.O.G. conforming to ASTM A182/A182M and ASME B16.11. Threaded fittings must only be used for above grade applications. Underground and in pits low point drain pipe and high point vent pipe must be butt welded.

c. Unions. Conforming to ASTM A312/A312M, Grade 304 or 316.

d. Flanges. 150 pound weld neck, forged Type 304 stainless steel flanges conforming to ASTM A182/A182M and ASME B16.5, except flanges that are to be connected to the fueling/defueling pumps must be 300-pound. For flanges 2" and smaller located in contained pumphouses, contained truck offloads, contained truck fill stands, and other visibly contained areas the fitting may be forged (socket welded), 900 kg 2,000-pound W.O.G., conforming to ASTM A182/A182M and ASME B16.11. In pits, vaults, on PRV piping for pipeline routes, and other uncontained locations the connection must be butt welded. Flanges to be 1/16-inch raised-face with phonographic finish, except where required otherwise to match equipment furnished. Match flange face to valves or equipment furnished. Flanges must be subjected to the Supplementary Requirements S56, Liquid Penetrant Examination as outlined in ASTM A961/A961M. Detectable flaws will not be acceptable.

e. Stainless Steel Tube Fittings. Flareless, 316 stainless steel fittings conforming to SAE J514.

2.1.5.4 Isolating Gasket Kits (Insulating) for Flanges

Provide ASTM D229 electrical insulating material of 1,000 ohms minimum resistance or 500 Volts per Mil (VPM) minimum dielectric strength; material must be resistant to the effects of aviation hydrocarbon fuels. Provide full face insulating gaskets between flanges with fluoroelastomer (FKM), commonly referred to as Viton, O-ring sealing

surfaces. Provide full surface 0.03-inch thick wall thickness, spiral-wound mylar insulating sleeves between the bolts and the holes in flanges; bolts may have reduced shanks of a diameter not less than the diameter at the root of threads. Provide 0.125-inch thick high-strength phenolic insulating washers next to flanges and provide flat circular stainless steel washers over insulating washers and under bolt heads and nuts. Provide bolts 0.5-inch longer than standard length to compensate for the thicker insulating gaskets and the washers under bolt heads and nuts. Above grade flanges separated by electrically isolating gasket kits must be provided with weatherproof lightning surge arrester devices. The surge arrester must bolt across flanges separated by insulating gasket kits per detail on contract drawings. The arrestor must have the following features:

a. Weatherproof NEMA 6P enclosure.
b. Bidirectional and bipolar protection.
c. Constructed of solid state components, no lights, fuses or relays and used without required maintenance or replacement.
d. Withstand unlimited number of surges at 50,000 Amperes.
e. Maximum clamping voltage of 700 Volts based on a IEEE C62.41 8x20 microsecond wave form at 50,000 Amperes peak measured at the device terminals (zero lead length).
f. A UL listed arrester for installation in Class 1, Division 1 or Class 1, Division 2, Group D, hazardous areas.

Install the mounting bracket and leads on the flange side of the bolt insulating sleeve and washer, and size in accordance with this schedule:

Line Size	Bolt Size
2 inch	5/8 inch
2.5 inch	5/8 inch
3 inch	5/8 inch
4 inch	5/8 inch
6 inch	3/4 inch
8 inch	3/4 inch
10 inch	7/8 inch
12 inch	7/8 inch
14 inch	1 inch
16 inch	1 inch

Note: Make allowance for the 1/32-inch thickness of the insulating sleeve around the bolts when sizing the mounting lugs.

2.1.5.5 Flange Protectors

Protect the bolts, studs, nuts, and gaskets of a flanged end connection from corrosion or damage due to exposure to the environment. Protectors must be weather and ultraviolet (UP) resistant. Protectors must allow for quick and easy removal and re-installation by maintenance personnel.

Provide grease filled bolt caps. Provide non-expansive corrosion prevention grease and design for the service. Provide protectors that allow for visual inspection of the flange gasket without requiring removal. Provide protectors with grease fittings which allow the injection of grease into the flange cavity.

2.1.6 Nuts and Bolts

Bolts and nuts for pipe flanges, flanged fittings, valves and accessories must conform to ASME B18.2.1 and ASME B18.2.2, except as otherwise specified. Bolts must be of sufficient length to obtain full bearing on the nuts and must project no more than three full threads beyond the nuts with the bolts tightened to the required torque. Bolts must be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A193/A193M, Class 2, Grade B8, stainless steel, when connections are made where a stainless steel flange is involved, and Grade B7, chromium molybdenum alloy, when only carbon steel flanges are involved. Bolts must be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Nuts must conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7, chromium molybdenum allow for chromium molybdenum alloy bolts. Nuts must be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch. Provide washers under bolt heads and nuts. Use chromium molybdenum alloy washers dimensioned to ASTM F436 flat circular for chromium molybdenum bolts. Stainless steel washer dimensioned in accordance with ASTM F436 flat circular, use material the same as the bolt. Use torque wrenches to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tight in the pattern recommended by the gasket manufacturer. Use anti-seize compound on stainless steel bolts.

2.1.7 Gaskets

ASME B16.21, composition ring, using a Buna-N, polytetrafluoroethylene (PTFE), or a protein and glycerin binder, 0.1250-inch thick. Gaskets must be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Full-face gaskets must be used for flat-face flanged joints. Ring gaskets must be used for raised-face flanged joints. Gaskets must be of one piece factory cut.

2.1.8 Relief and Drain System Piping

Pressure relief valve discharge lines and drain lines to the product recovery tank must be Schedule 40 [API Spec 5L Grade B or ASTM A53/A53M Grade B Carbon Steel] [ASTM A312/A312M seamless Type 304L Stainless Steel]. See Gaskets specified herein before.

2.1.9 Relief and Drain System Protective Coating

Pipe must be factory coated as specified herein before for steel piping.

2.1.10 Stainless Steel Field Applied Protective Coatings

The field joints and fittings of all underground piping must be coated as herein specified.

2.1.10.1 Welded Joints

Heat shrinkable radiation-cross-linked polyolefin wraparound type sleeves must be applied to all welded joints. Joints must not be coated until pressure testing is complete. Apply sleeves consisting of 40 mil polyolefin backing and 40 mil thermoplastic mastic adhesive in accordance with the manufacturer's instructions.

2.1.10.2 Tape for Fittings

Fittings and other irregular surfaces must be tape wrapped. The tape must be a plastic mastic laminated tape having 6 mil plastic backing of either polyethylene or polyvinylchloride and 29 to 44 mil of synthetic elastomer.

2.1.11 Threaded Joints

Threaded joints, if indicated on the drawings, must be made tight with manufacturer recommended PTFE tape or a mixture of graphite and oil, inert filler and oil, or with a graphite compound, applied with a brush to the male threads. Not more than three threads must show on made up joints. Threaded joints, mechanical couplings and flanges will not be permitted in buried piping. Threaded joints must not get welded.

2.1.12 Welded Joints

Welded joints in steel pipe must be as specified in Part 3.

2.2 MANUAL VALVES

All portions of a valve coming in contact with fuel in stainless steel pipe lines or epoxy lined carbon steel pipe lines must be of noncorrosive material. Valves in stainless steel pipe lines or epoxy lined carbon steel pipe lines must be Type 304 or Type 316 stainless steel or carbon steel internally plated with chromium or nickel or internally electroless nickel plated. Valves in unlined carbon steel pipelines must have carbon steel body. Stem and trim must be stainless steel for all valves. Manually operated valves 6 inches and larger must be worm-gear operated and valves smaller than 6 inches must be lever operated or handwheel operated. Valves smaller than 2 inches must have lever-type handles. Handles installed more than 6 feet above finished floor must have chain operators. Valve indicators installed higher than 5 feet must have a position indicator visible from ground level. Sprocket wheel for chain operator must be aluminum. Valves in the isolation pits in fuel piping between the pig launchers and the pig receivers must be full bore, piggable, double block and bleed type. The full bore piggable valves at the launcher and the receiver must be ball type.

2.2.1 Ball Valves

Ball valves must be fire tested and qualified in accordance with the requirements of API Std 607 and API STD 608. Seal material for the fire test must be graphite, seal material for the project must be as as indicated below. Ball valves must be nonlubricated valves that operate from fully open to fully closed with 90 degree rotation of the ball. Valves 2 inches and larger must conform to applicable construction and dimension requirements of API Spec 6D, ANSI Class 150 and must have flanged ends. Valves smaller than 2 inches must be ANSI class 150 valves with flanged ends, unless noted otherwise. The balls in valves 10 inches full port and 12 inch regular port and larger must have trunnion type

support bearings. Except as otherwise specified, reduced port or full port valves may be provided at the Contractor's option. Balls must be solid, not hollow cavity.

2.2.1.1 Materials

Ball must be stainless steel. Ball valves must have polytetrafluoroethylene (TFM) or fluoroelastomer (FKM), commonly referred to as Viton seats, body seals and stem seals. Valves 4 inches and smaller must have a locking mechanism.

2.2.1.2 Full Port Ball (DBBV) Valves for Piggable Lines

Ball valves must be designed, manufactured, and tested to API Spec 6D, fire-safe and tested to API Spec 6FA, and BS EN ISO 10497 (BS 6755, Part 2). Seal material for the fire test must be graphite, seal material for the project must be as as indicated below. Valves must be trunnion-mounted with independent spring and hydraulically actuated, floating, single piston effect, self-relieving seat rings, with bi-directional sealing. Ball must be solid type with full through-conduit opening, suitable for passage of pipeline pigs. Stem must be anti-static, blow-out-proof design with o-ring seals and provided with an emergency sealant injection fitting. Valves must be 3-piece, bolted body design with raised-faced ANSI Class 150 flanged connections, equipped with body drain/bleed valve and vent fitting, and suitable for double block and bleed service in the closed and open positions. Valves must be all stainless steel construction, or carbon steel with stainless steel stem, and all wetted parts electroless nickel-plated. Valves must have nylon or polytetrafluoroethylene (TFM) seat inserts, FKM B body, stem, and seat o-rings, with stainless steel and graphite body gaskets and graphite secondary stem seals. Valves located in vaults or pits must be equipped with actuator extensions.

2.2.1.3 Electric Valve Actuator

Electric valve actuator must be as indicated for Plug (Double Block and Bleed) Valves, electric valve actuator.

2.2.2 Plug (Double Block and Bleed) Valves

API Spec 6D, ANSI Class 150, non-lubricated, resilient, double seated, trunnion mounted, tapered lift plug capable of two-way shutoff. Valve must have tapered plug of steel or ductile iron with chrome or nickel plating and plug supported on upper and lower trunnions. Sealing slips must be steel or ductile iron, with Viton seals which are held in place by dovetail connections. Valve design must permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Valves must operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valves must have weatherproof operators with mechanical position indicators. Indicator shaft must be stainless steel. Minimum bore size must be not less than 65 percent of the internal cross sectional area of a pipe of the same nominal diameter unless bore height of plug equals the nominal pipe diameter and manufacturer can show equal or better flow characteristics of the reduced bore size design. Full port plug valves in distribution piping must be provided with a 1/2-inch threaded body drain.

2.2.2.1 General

Valves in the operating tank suction and fill lines and the valves at the four valve manifold in the pump room in the tank fill lines must be provided with a factory-installed limit switch that is actuated by the valve closure. Tank fill line valve and four valve manifold limit switches must be provided with one double pole double throw contacts or four single pole, double throw contracts, two for open, two for closed. Tank suction line valve limit switches must be provided with one double pole double throw contacts or four single pole, double throw contacts, for closed, and one single pole double throw contact or two single pole, double throw contacts for open. All components must be watertight and U.L. listed for Class I, Division 1, Group D hazardous areas.

2.2.2.2 Valve Operation

Rotation of the handwheel toward open must lift the plug without wiping the seals and retract the sealing slips so that during rotation of the plug clearance is maintained between the sealing slips and the valve body. Rotation of the handwheel toward closed must lower the plug after the sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, the slips must form a secondary fire-safe metal-to-metal seat on both sides of the resilient seal. Plug valves located in Isolation Valve Pits or vaults must be provided with handwheel extensions.

2.2.2.3 Relief Valves

ANSI Class 150. Provide plug valves with automatic thermal relief valves to relieve the pressure build up in the internal body cavity when the plug valve is closed. Relief valves must open at 25 psi differential pressure and must discharge to the throat of, and to the upstream side, of the plug valve.

2.2.2.4 Bleed Valves

ANSI Class 150, stainless steel body valve. Provide manually operated bleed valves that can be opened to verify that the plug valves are not leaking when in the closed position.

2.2.2.5 Electric Valve Actuator

The actuator, controls and accessories must be the responsibility of the valve-actuator supplier for sizing, assembly, certification, field-testing and any adjustments necessary to operate the valve as specified. The electric valve actuator must include as an integral unit the electric motor, actuator unit gearing, limit switch gearing, position limit switches, torque switches, drive bushing or stem nut, declutch lever, wiring terminals for power, remote control,indication connections and handwheel. The electrically actuated plug valve must be set to open and close completely in 30 to 60 seconds against a differential pressure of 275 PSIG. The actuator settings of torque and limit contacts must be adjustable. The valve actuator must be suitable for mounting in a vertical or horizontal position and be rated for 30 starts per hour. The valve actuator must be capable of functioning in an ambient environment temperature ranging from -32 to 158 degrees F.

a. The electrical enclosure must be specifically approved by UL or Factory Mutual for installation in Class I, Division 1, Group D

locations.

b. The electric motor must be specifically designed for valve actuator service and must be totally enclosed, non-ventilated construction. The motor must be capable of complete operation at plus or minus 10 percent of specified voltage. Motor insulation must be a minimum NEMA Class F. The motor must be a removable subassembly to allow for motor or gear ratio changes as dictated by system operational requirements. The motor must be equipped with an embedded thermostat to protect against motor overload and also be equipped with space heaters. It must de-energize when encountering a jammed valve.

c. The reversing starter, control transformer and local controls must be integral with the valve actuator and suitably housed to prevent breathing or condensation buildup. The electromechanical starter must be suitable for 30 starts per hour. The windings must have short circuit and overload protection. A transformer, if needed, must be provided to supply all internal circuits with 24 VDC or 110 VAC may be used for remote controls.

d. The actuator gearing must be totally enclosed in an oil-filled or grease-filled gearcase. Standard gear oil or grease must be used to lubricate the gearcase.

e. The actuator must integrally contain local controls for Open, Close and Stop and a local/remote three position selector switch: Local Control Only, Off, and Remote Control plus Local Stop Only. A metallic handwheel must be provided for emergency operation. The handwheel drive must be mechanically independent of the motor drive. The remote control capability must be to open and close. Rim pull to operate valve manually must not exceed 80 pounds.

f. Position limit switches must be functional regardless of main power failure or manual operation. Four contacts must be provided with each selectable as normally open or normally closed. The contacts must be rated at 5A, 120 VAC, 30 VDC.

g. Each valve actuator must be connected to a PLC supplied by "others".

h. The actuator must have a local display of position even when power has been lost.

i. The actuator must be supplied with a start-up kit comprising installation instruction, electrical wiring diagram and spare cover screws and seals.

j. The actuator must be performance tested and a test certificate must be supplied at no extra charge. The test should simulate a typical valve load with current, voltage, and speed measured.

2.2.3 Swing Check Valves

Swing check valves must conform to dimensional requirements of API Spec 6D, regular type, ANSI Class 150 with flanged end connections. Check valves must conform to API STD 600 and be swing type with material as previously indicated herein. Discs and seating rings must be renewable without removing the valve from the line. The disc must be guided and controlled to contact the entire seating surface.

2.2.4 Silent Check Valves

Spring assisted, wafer/lug pattern, butterfly check with FKM or PTFE seat ring, designed to prevent flow reversal slamming of valve, dual plate, and must conform to ASME B16.34, API Std 594, except face to face dimensions may deviate from standard. Valves must be suitable for installation in any orientation. Valve body and trim material must be as previously indicated herein.

2.2.5 Butterfly Valve with Fusible Link Operator

Valve must conform to API Std 609. Valve must meet the fire test requirements of API Std 607. Valve must be designed for bubble tight bidirectional shutoff service at operating conditions. Disc must be Type 304L or Type 316, stainless steel. Stem must be ASTM A276/A276M Type 416 or ASTM A564/A564M Type 630 stainless steel. Seal ring must be Teflon with metal backup. Stem seals must be capable of withstanding the rated pressure and temperature of the valve seat. Provide valves 6 inches and larger and valves at pump discharge with weatherproof gear operators with handwheel; other valves must have minimum 10 position throttling handles. Valve must have a fusible link type valve operator. The fusible link and spring assembly must close the valve automatically when the link material melts at 165 degrees F and lock the valve in the closed position. Spring assembly must be fully enclosed to ensure safety. Provide valve with flanged end connections independent of other flanged end connections provided on items such as equipment, piping, piping components, or valves.

2.3 RELIEF VALVES

Relief valves must be the fully enclosed, spring loaded, angle pattern, single port, hydraulically operated type with plain caps, and must be labeled in accordance with ASME BPVC SEC VIII D1 (GPM). Valve stems must be fully guided between the closed and fully opened positions. The valves must be factory-set to open at 265 psi unless otherwise indicated on the drawings. Operating pressure must be adjustable by means of an enclosed adjusting screw. The valves must have a minimum capacity of 20 GPM at 10 percent overpressure. Valves must have a replaceable seat. Relief valves that do not relieve to a zone of atmospheric pressure or tank must be a balanced (non-ASME) type relief or regulator valve.

2.3.1 Valve Materials

Valves must have carbon steel bodies (stainless steel on SS pipelines) and bonnets with stainless steel springs and trim. Valves must be Class 150 flanged end connections.

2.3.2 Quick Disconnect

If indicated on drawings provide quick disconnect on relief valve system. Quick disconnects must be double shut-off, dry-break design, 316 stainless steel construction, with Fluorocarbon (Viton) seals, minimum working pressure of 1000 psig at 100°F., with ½" female NPT threaded connections for both coupler and adapter, manufactured in accordance with ISO 7241, Series B. The couplers and nipple/adapters are to be provided with aluminum dust caps to protect the fitting when not in use. Five nipple/adapters are to be provided to the installation for connecting to government test equipment.

2.4 PIPING ACCESSORIES

2.4.1 Flexible Ball Joints

Flexible ball joints must be [stainless steel] [carbon steel with electroless nickel-plating to a minimum of 3 mils thickness], capable of 360-degree rotation plus 15-degree angular flex movement, ASME B16.5, Class 150 flanged end connections. Provide either pressure molded composition, PEEK, or polytetrafluoroethylene (TFM) gaskets designed for continuous operation temperature of 275 degrees F. Joints must be designed for minimum working pressure of ANSI Class 150. Injectable packing will not be allowed.

2.4.2 Pipe Sleeves

Pipe sleeves must be installed where indicated and at all points where the piping passes through concrete construction. Such sleeves must be of sufficient inside diameter to provide a minimum clear distance between the pipe and the sleeve of 1/2-inch. Sleeves through concrete pits or slabs must be standard weight carbon steel pipe with a protective coating. Each sleeve must extend through the respective pit wall or slab and must be provided with a Buna-N casing seal (Viton when exposed to sunlight). Sleeves where piping passes under roads or piping indicated to be double walled must be standard weight carbon steel pipe with a protective coating as previously specified. Alignment of the sleeve and piping must be such that the pipe is accurately centered within the sleeve by a nonconductive centering element. The sleeve must be securely anchored to prevent dislocation. Closure of space between the pipe and the pipe sleeve must be by means of a mechanically adjustable segmented elastomeric seal. The seal must be installed so as to be flush.

2.4.3 Strainers

2.4.3.1 Basket Type

Strainer must be single or multi (four) basket type as indicated in compliance with MIL-PRF-13789, except as specified otherwise. Strainer end connections must be designed in accordance with ASME B16.5, Class 150. Strainer body material must be the same as the material specified for manual valves. Strainers must have removable baskets of 60 mesh wire screen with larger wire mesh reinforcement; wire must be stainless steel, Type 316. Pressure drop for clean strainer must not exceed 3 psig at maximum design flow rate. The ratio of net effective strainer area to the area of the connecting pipe must be not less than three to one. Each strainer must be provided with a suitable drain at the bottom, equipped with a ball valve. The strainer must be equipped with a direct-reading, piston type differential pressure gauge that measures the differential pressure across the basket. The gauge must consist of a spring-supported, corrosion resistant piston moving inside a glass cylinder, with high pressure applied on top of the piston and low pressure applied below it. Under a differential pressure of 30 PSI, leakage past the piston must not exceed 120 drops per minute. The cylinder and flanges must be stainless steel with Viton O-ring seals. The high pressure inlet of the gauge must have a 10-micron pleated paper filter and the low pressure connection must have a fine mesh stainless steel strainer. The gauge must have an operating pressure of 300 PSI. Differential pressure range of the gauge through approximately 3 inches of piston movement must be 0-30 PSI with an accuracy of $\pm$ 0.5 PSI, calibrated linearly with one PSI scale graduations. High and low pressure connections must be 1/4 inch NPT

female with a stainless steel bar stock valve at each connection. Construction of the gauge must be such that a 3-valve manifold is not necessary. If only one bar stock valve is closed, the gauge must not be damaged by up to 300 PSI differential pressure in either direction. A pressure gauge must be attached to the differential pressure gauge to indicate the high pressure and have a range of 300 psi.

2.4.3.2 Cone Type

Strainer must be stainless steel type 304 or 316, 100 mesh screen with the ratio of net open area of strainer to the area of the connecting pipe must be not less than three to one at the pump suction, and 5/32-inch perforations and suitable for bi-directional flow at the inlet to the hydrant pit control valves.Pump suction strainer must have a 100 mesh screen with not less than 300% open area (ratio of the strainer open area to the cross section of pipe). Hydrant pit control valve strainer must be the basket type, have 5/32 inch perforations, suitable for bidirectional flow, and have a minimum 200% open area.

2.4.4 Pipe Supports

2.4.4.1 General

Pipe supports must conform to MSS SP-58. Supports must be provided at the indicated locations. Support channels for drain lines must be epoxy coated on all surfaces or hot-dip galvanized after the channels are cut to length. Coated supports must be coated with fusion bonded epoxy resin applied by the fluidized bed method. Thickness of the coating must be not less than 10 mils. Surface preparation and coating application must be in accordance with the epoxy manufacturer's instructions. The coating must be pinhole free when tested with a low voltage holiday detector set at no more than 100 times the mil thickness of the coating. All pinholes must be marked, repaired and retested to ensure a pinhole free film. The coating material must be a 100 percent solids, thermosetting, fusion-bonded, dry powder epoxy resin. The manufacturer must certify that the material is suitable for fluidized bed application and that it is approved by the Environmental Protection Agency. A PTFE pad must be installed between the pipe and the u-bolt.

2.4.4.2 Adjustable Pipe Supports

Adjustable pipe supports must consist of a cast iron saddle and a threaded nipple connected to a carbon steel pipe by means of a special reducer conforming to MSS SP-58. The supports must be provided with PTFE insulation strips.

2.4.4.3 Low Friction Supports

Low friction supports must be self-lubricating antifriction element composed of reinforced PTFE. Units must be factory designed and manufactured.

2.4.4.4 Concrete and Grout

Concrete and grout for anchors and supports must comply with SECTION 03 30 00 CAST-IN-PLACE CONCRETE.

2.4.5 Sample Connections

a. Sample connections must be factory assembled units specifically designed for obtaining representative samples from fuel pipelines. Each connection must include a 1/4-inch sampling probe where the probe faces upstream, ball valve and 1/4-inch quick disconnect coupling with dust plug, all assembled into a unit that is suitable for installation in a pipe nipple. The sampling probe must extend not less than one inch into the fuel pipe. All materials in the sample connections must be stainless steel or aluminum.

b. Furnish two sampling hose assemblies to the Contracting Officer at the project site. Each assembly must consist of a 6-foot length of 1/4-inch clear plastic tubing with internal bonding/grounding wire. One end of the tubing will contain a male connector that actuates flow when inserted into the quick disconnect coupler. Each end of the bonding/grounding wire must be equipped with clips for attaching to the pipe and metal sample container.

2.4.6 Flanged Swivel Joints

Flanged swivel joints must be stainless steel, single plane, capable of rotating 360 degrees. Welded swivel joints and welding of swivel joints to the pipe and/or elbow is not permitted. Swivel joints must be of the non-lubricated, maintenance free type with sealed bearings and no lubricating fitting. Swivel joint must be flanged at the end connecting to the piping system and threaded (female NPT) at the end connecting to the fuel hose. No leakage must be permitted under positive or negative pressure conditions. No leakage must be permitted under high or low temperature conditions. Welding of swivel joint to six-bolt flange connector is permitted. The swivel joints must be warranted for three years against leakage. There must be electrical continuity from one flange to the other without the use of ground straps. The electrical continuity from one flange to another (without the use of ground straps) must be less than 1000 ohms. Each swivel joint must have two ball bearing raceways, primary and secondary seals with leak detection port, and dust seal.

2.4.7 Monitoring Points

At the following locations, provide half-inch pipe, flanged ball valve, and blind flange for future test equipment connections:

a. On the filter separator discharge header in the pumphouse.

b. At the Hydrant Hose Truck Checkout, inlet to Hydrant Valve.

c. At the inlet to the Back Pressure Control Valve in the Pumphouse.

d. At both sides of the isolation valve in all the isolation valve pits.

2.4.8 Fuel Hose

Fuel hose must conform to EI 1529, Grade 2, Type C, threaded, male NPT, both ends.

2.4.9 Top Loading Arms

Top loading arm ([2"-100][3"-200][4"-300]gpm) must have sufficient

horizontal reach and pivot points to assure the vehicle does not have to be re-spotted. Drop pipe length must be able to reach fill tank bottom and be at a safe elevation for refueler operation. Loading arm must have four planes of movement: up-down (to allow drop pipe to enter tank), side to side (to allow arm to rotate out to tank and back out of position), drop-tube (to assure drop-tube remains vertical), scissor arm pivot (which allows 360 degree rotation of secondary arm allowing the drop-tube to reach further out thus allows a larger spotting distance). Materials of construction must be stainless steel. Arm must be counterweight or spring assisted for effortless operation of loading arm. Swivel joints must be of the non-lubricated, maintenance free type with sealed bearings and no lubricating fittings. Assembly must be a regular product for the purpose of top loading fuel from a manufacturer who has successfully provided the product for at least the past five years.

2.4.10 Pressure Fueling Nozzle

Nozzles must conform to SAE AS5877, Type [D-1] [D-2] [D-3]. Nozzles and nozzle components must be compatible with the fuel to be handled. Nozzles must be provided with an internal 60 mesh stainless steel strainer and a fuel sample connection tapping. Nozzle design must be for single point fueling of aircraft. Nozzles must be provided with a compatible dry break quick disconnect swivel. Coupler must allow for quick disconnect and reconnect of fueling nozzles with corresponding adapters. Coupler and adapter must provide a positive, leak proof connection under constant or surge flow. Coupler must be designed to prevent blowout of internal poppet.

2.4.11 Nozzle Adapter (SPR)

Adapter must be a nominal 2-1/2 inches with self-closing valve in accordance with MIL-A-25896. Adapter must have a 4 inch flange mounting and vacuum tight, locking dust cap using the SPR lugs.

2.4.12 Pigging Accessories

2.4.12.1 Closure Door

The closure must be hinged, swing bolted closure of the same material as the pipe and for a Class 150 system. Gasket must be nitrile. Eye bolts must be pinned to lugs on the hub.

2.4.12.2 Signaler

The pig signaler must be mechanical flag type with manual reset, and be located on the pig launcher and the pig receiver. Material in contact with the fuel must be stainless steel. Units must be suitable for removal and installation under line pressure of 275 psig. Signaler must be capable of withstanding line pressure of a Class 150 system.

2.5 FLEXIBLE HOSES

Flexible hoses for fueling pumps must have ANSI Class 300 flanges to mate to the pump and Class 150 to connect to the system flanges of stainless steel construction conforming to ASME B16.5. Flexible hoses must be of stainless steel flexible metal hose consisting of an inner corrugated stainless steel tube with stainless steel braid cover and stainless steel flanges. All components to be suitable for not less than 275 psig. Length and application of flexible hoses must be per manufacturer's

written recommendations.

2.6 AUTOMATIC AIR VENT

Unit must have one-inch connections and automatically vent air under pressure, and prevent a vacuum when pressure drops below a positive pressure. As fuel fills the vent, a float must rise and form a drip-tight closure. The unit pressure rating must be a minimum of 275 psi. The float must be stainless steel. Body and cover be carbon steel or ductile iron and be internally epoxy coated.

2.7 SURGE SUPPRESSOR TANK AND VALVE

The unit must be fabricated from carbon steel, internally coated pressure vessel with a rubber bladder or a stainless steel diaphragm separating the fuel from the gas charge. The epoxy coating must be in accordance with MIL-PRF-4556. The rubber bladder must be molded synthetic nitrile rubber (Buna-N). The unit must be constructed and labeled in accordance with ASME BPVC SEC VIII D1. The housing must be designed for a working pressure of 275 PSIG. The gas precharge must be dry nitrogen and must have a pressure gauge, gas valve, and an adapter for field charging. Bladder precharge pressure must be 80 PSIG. The connection to the piping system must be Class 150 ANSI flange, size as indicated on the drawings. The connection must have a check valve to provide unrestricted flow into the vessel and restricted flow from the vessel. The flange must have a 1/2-inch NPT connection with a valve and adapter to relieve fluid pressure during gas recharging and to drain the vessel during removal. A charging assembly must be provided. The surge control supplier must furnish a service person trained to provide installation check-out assistance and to supervise operation and testing necessary to place the surge control system into service and to provide training on charging, recharging, and checking the surge suppressor.

PART 3 EXECUTION

3.1 VERIFICATION OF DIMENSIONS

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 CLEANING OF PIPING

Keep the interior and ends of all new piping, affected by construction operations, thoroughly cleaned of foreign matter and water before and after being installed. Piping systems must be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of piping and fittings must be closed so that no water or other foreign substance will enter the pipes or fittings. Piping must be inspected before placing into position. The interior of each length of pipe must be cleaned after welding insuring that the interior of the piping is free of foreign matter when it is connected into the system.

3.3 TRENCHING AND BACKFILLING

Trenching and backfilling must conform to Section 31 00 00 EARTHWORK, and the following bedding and backfill requirements. The pipe must be laid in a bed of sand 6 inches deep, compacted in accordance with Section 31 00 00

EARTHWORK, paragraph "Backfilling and Compaction". Sand must meet the requirements of Section 31 00 00 EARTHWORK, paragraph "Select Granular Material". The full length of each section of pipe without any protective covering must be excavated to permit installation of the protective covering. Pipe that has the grade or joint disturbed after laying, must be taken up and relaid. Pipe must not be laid in water or when the trench or weather conditions are unsuitable for such work. After testing and application of protective covering to joints, sand backfill must be placed and compacted around the pipe or protective coating to a depth of 1 foot above top of pipe. The remainder of the backfill must be the same as for other types of pipe.

3.4 PIPING LAYOUT REQUIREMENTS

3.4.1 Pipe Fabrication

Fabricate piping to measurements established on the project site and position into place without springing or forcing. Make provisions for absorbing expansion and contraction without undue stress in any part of the system. The use of flexible hoses in permanently mounted pump suction and discharge lines as a method of compensating for piping misalignment is not acceptable.

3.4.2 Interferences and Measurements

Provide offsets, fittings, and accessories required to eliminate interferences and to match actual equipment connection locations and arrangements. Verify measurements before commencing work. Submit discrepancies for clarification before proceeding with the installations to the Contracting Officer.

3.4.3 Space and Access

Keep piping, control tubing, which is not detailed close to structures and columns so as to take up a minimum amount of space. Ensure that access is provided for maintenance of equipment, valves and gauges.

3.4.4 Location

Do not place unions in locations that will be inaccessible after the completion of the work. Place unions on each side of equipment.

3.4.5 Piping and Equipment

Provide anchors where required to absorb or transmit thrust or eliminate vibration or pulsation. Provide hangers and supports near each change of direction. Select support components which do not restrict the movement of the pipe due to thermal expansion. Space hangers uniformly and arrange symmetrically.

3.4.6 Structural Support

Provide supplementary or intermediate steel or other structural members as required for transmission of loads to members forming part of the supporting structure. Piping must not be supported from other piping.

3.4.7 Grade

Where profiles of piping lines are shown on the drawings, grade the line

uniformly between changes in slope or direction. Maintain gradient to within ± 1/4-inch over the entire length of pipe. When backfilling has been completed to the top of the pipe, the pipe must be surveyed at each joint, and logged by station number. Submit to the Contracting Officer for approval the survey final elevations before backfilling can continue.

3.4.8 Size Changes

Make changes in pipe size with reducing fittings. Do not use bushings. In lieu of welding reducing outlet tees for piping 2 inches and larger, welding branches suitable for 100 percent radiographic inspection may be used. Do not use weldolets unless specifically called out (labeled) on the drawings.

3.4.9 Direction Changes

Make changes in direction of pipes with long radius fittings. Provide special fittings when required. Do not make miter welds. Make odd-angle offsets with pipe bends or elbows cut to the proper angle.

3.5 WELDING

3.5.1 General

All joints, unless indicated otherwise, in carbon steel and stainless steel piping systems must be welded. Welding of fuel pipe joints must comply with Section 33 52 23.15 SERVICE PIPING WELDING.

3.6 INSTALLATION

3.6.1 Precautions

Take special care to ensure that the protective coating on buried pipe is not damaged during installation and that the completed system is free of rocks, sand, dirt, water, weld slag, and foreign objects including construction debris. Take the following steps to ensure these conditions.

a. Coated pipe must be handled only with canvas or nylon slings or padded clamps. Any coating damaged by improper handling or storage must be repaired as specified.

b. Pipe brought to the site must be stored on blocks or horses at least 18 inches above the ground and adequately supported to prevent sagging. Padded blocks or horses must be used for coated pipe. The method and height of storing coated pipe must be in accordance with the coating manufacturer's instructions. Pipe ends must be protected and capped against weather at all times, except to accommodate immediate installation.

c. Visual inspection must be made of the inside of each length of pipe to ensure that it is clear and clean prior to installation.

d. The open ends of the pipe system must be closed at the end of each day's work or when work is not in progress by use of expansion plugs and must not be opened until the work is resumed.

e. A swab, with a leather or canvas belt disc to fit the inside diameter of pipe, must be pulled through each length of pipe after welding in place.

f. Obstruction remaining in the pipe after completion of the system must be removed at the expense of the Contractor.

g. Plasma cutters and torches are not to be used to make penetrations in the pipe or to cut pipe.

h. After installation and backfill of the hydrant loop is complete and before fuel is put in the pipe, the pipe will be cleaned using foam swabs and poly coated wire brush pigs and compressed dry gas, residual humidity of not over 20 percent. Ten flights of a combination of swab and brush pigs must be run. During this, low point drains and high point vents must be blown clean.

[3.6.2 Protective Coatings for Buried Stainless Steel Piping

3.6.2.1 Application of Tape Wrapping

Surfaces to receive tape must be clean, dry, grease-free and dust-free. Extruded polyethylene coating and adhesive undercoat surfaces to be tape wrapped must be primed with a compatible primer prior to application of the tape. The primer must be as recommended by the tape manufacturer and approved by the extruded polyethylene coating manufacturer. Weld beads must be wire brushed. Burrs and weld spatter must be removed. Weld beads must be covered with one wrap of tape prior to spiral wrapping. Fittings must be wrapped spirally beginning with one complete wrap three inches back from each edge of the extruded polyethylene coating. For pipe less than four-inch size, one layer half-lapped must be used. For pipe 4-inch size and larger, two layers half-lapped must be used, with the second layer wrapped opposite hand to the first. On irregular surfaces one layer must be applied half-lapped and stretched to conform to the surface, followed by a second layer half-lapped and applied with the tension as it comes off the roll.

3.6.2.2 Inspection and Testing

The condition of factory field coated and wrapped piping must be the responsibility of the Contractor and all damage to the protective covering during transit and handling must be repaired at no additional cost to the Government. All field coating and wrapping must be subject to approval by the Contracting Officer. The entire pipe must be inspected as specified in sub-paragraph "Testing of Protective Coatings" under paragraph "Protective Coatings for Buried Steel Piping." The inspection for holidays must be performed just prior to lowering the pipe into the ditch and every precaution must be taken during lowering and backfilling to prevent damage to the protective covering.

3.6.2.3 Damage Repair

Damaged areas of extruded polyethylene coating must be repaired by tape wrapping as specified in the preceding paragraph for fittings. Residual material from the extruded polyethylene coating must be pressed into the break or must be trimmed off; all areas to be taped must be primed, and the tape must be applied half-lapped.

]3.7 INTERIOR EPOXY COATING

When internally epoxy lined pipe is cut, the lining must be ground back from the end a minimum of one inch but not more than 1-1/2 inches.

3.8 INSTALLATION OF UNDERGROUND PIPE

Underground fuel pipelines must be pitched as shown on the drawings. Where not indicated they must be pitched a minimum of 2 inches per 100 feet. Branch lines to the hydrant pits must slope up to the pit. Two-inch pipe size valved drain connections must be provided at all low points and 1-1/2-inch pipe size valved outlet vent connections must be provided at all high points. Vent and drain lines must terminate in male cam-type locking end connectors with matching female dust covers and installed in pits. The pipe must have cover as shown on the drawings. Drain lines must be installed at the slopes indicated.

3.8.1 Pipe Assembly

Pipe must be strung parallel and adjacent to or above a trench. The pipe must be supported on padded skids during welding and inspection of joints. Protective coating must be inspected and repaired prior to lowering the pipe into the trench. The pipe must be lowered using only canvas or nylon slings. The sling must be dug from underneath the pipe after placements and must not be pulled from underneath the pipe while in contact with it. Care must be taken to prevent damage to the pipe, welded joints or coating and any such damage must be repaired as directed by the Contracting Officer. Pressure testing of the pipe must be done after it has been placed in final position in the trench.

3.8.2 Warning Tapes in Earth Trenches

For the purpose of early warning and identification of buried pipes outside of building walls during future trenching or other excavation, continuous identification tapes must be provided in the trench. Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured for the purpose of early warning and identification of utilities buried below the tape. Tape must be at least 3 inches in width. Color of tape must be as standard with the manufacturer with respect to the type of utility buried below the tape. Tape must have lettering at least 1 inch high with warning and identification imprinted in bold black letters continuously over the entire tape length with not less than the following identification on the tape: BURIED JET FUEL PIPING BELOW. Tape must be installed in accordance with the printed recommendations of the tape manufacturer, as modified herein. Tapes must be buried at a depth of 6 inches from the top of the subgrade or 12 inches below the top surface of earth. Provide permanent color and printing, unaffected by moisture or soil.

3.8.3 Clearances

Install pipe to be clear of contact with other pipes, pipe sleeves, casings, reinforcing steel, conduits, cables, or other metallic structures. Where pipes cross other pipes or structures with a separation of less than 6 inches, install an insulating separator. Protect the pipe from contact with a 12-inch square by 1 inch thick bituminous-impregnated cane fiber board.

3.8.4 Protective Coating

When the protective coating on pipe is damaged, the Contracting Officer must be notified and must inspect the pipe before the coating is patched. If the damage to the pipe is deeper than 0.050-inch, the damage must be

repaired by welding in accordance with paragraph "WELDING". If the pipe is dented, out of round or damaged to the point that welding will not make it good as new, the length of pipe must be rejected.

3.9 TESTING

Piping must be tested by pneumatic and hydrostatic pressure. Testing must comply with applicable requirements of ASME B31.3, NFPA 30 and the requirements specified herein. Hydrostatic testing must be performed using fuel as the liquid. Water must not be introduced into the system for testing. Pneumatic and hydrostatic testing must be performed only after welding inspection has been completed.

3.9.1 Pneumatic Test

Piping to be installed underground must not receive field applied protective covering at the joints or be covered by backfill until the piping has passed the pneumatic test described herein. To facilitate the tests, isolate various sections of the piping system and test each one separately. Where such sections terminate at flanged valve points, the line must be closed by means of blind flanges in lieu of relying on the valve. Furnish tapped flanges that can be attached to the end of the section of line being tested, and that will permit a direct connection between the piping and the air compressor and/or pressurizing pump. No taps in the permanent line will be permitted. Furnish all necessary equipment for testing; all gauges must be subject to testing and approval of the Contracting Officer. The air used for pneumatic testing must have a dew point of no more than 41 degrees F. Provide dehumidifying equipment on the suction or discharge side of the air compressor used to provide air for testing. Pressurizing pump must not exceed 10 cfm.

3.9.1.1 Pneumatic Test Procedure

Special safety measures, including the wearing of face mask, must be taken during testing under pressure. Only authorized personnel must be permitted in the area during testing. The pneumatic test pressure must be applied in increments. A preliminary 25 psig test must be applied. Examine joints with soap solution. Leaks revealed by this test must be repaired. The full test pressure must then be applied. Unless otherwise directed by the Contracting Officer, all piping must be tested at a pressure of [50][100]psig for not less than 2 hours, during which time there must be no drop in pressure, only pressure rises with temperature. The pressure source must be disconnected during the final test period. Any leaks revealed by the test must be repaired and the test repeated.

3.9.1.2 Hydrostatic Test

Upon completion of pneumatic testing and after backfilling, hydrostatically test each piping system with fuel at [275][_____]psig in accordance with ASME B31.3 and API RP 1110, with no leakage or reduction in gauge pressure for four hours. Furnish electricity, instruments, connecting devices, and personnel for test. Fuel must be furnished by the Government. Defects in work must be corrected at the Contractor's expense, and the test repeated until the work is proven to be in compliance with the Contract requirements.

3.9.2 Performance Testing

After the system is completed (including pneumatic and hydrostatic

testing) the fuel system must be cleaned and performance tested as specified in Section 33 08 53 AVIATION FUEL DISTRIBUTION SYSTEM START UP. All control valves, both manual and automatic, must be checked for leaks (any area wetted with fuel) and proper operation and adjusted, repaired or replaced to correct any defects.

3.10 PIPELINE PIGGING VERIFICATION

3.10.1 Geometry/Ultrasonic Tool Reports

After the system is installed and prior to performance testing, a field/preliminary report must be issued and a debrief given to Government personnel onsite on the condition of the fuel hydrant loop. This must be comprised of raw data in the form of a PC download or equivalent which shows a continuous scan of each data unit output. Results of a preliminary interpretation of the data must be reported. These must include as a minimum all critical anomalies. A final report must include a description of the principle of operation, explanation of raw data, presentation of raw data, data to be clearly marked with distance traveled scale with classified anomaly location and all identifiable pipeline features, and all anomalies to be classified with locations in summary tabular form, pipe wall thickness survey, as well as the software necessary to read the data. Submittal must be in the form of digital media copied to a CD or DVD (flash drives are unacceptable).

3.10.2 Pipeline Internal Inspection Operations

3.10.2.1 General

The following pigs will be propelled through the pipeline with product in order to inspect the pipeline: 5 pound density foam swab, combination poly scraper-magnetic, stainless steel wire brush (plastic brush for internally lined piping), aluminum plate gauge, and geometry/ultrasonic tool. Tracking devices must be used on all pigs. At a minimum, the sequence of pig runs must be as follows: 1) foam swab for proving and cleaning, 2) wire brush for cleaning, 3) scraper-magnetic for cleaning, 4) aluminum plate gauge for gauging internal anomalies, 5) scraper-magnetic for cleaning, 6) wire brush for cleaning, 7) scraper-magnetic for cleaning, 8) foam swab for cleaning, (Note: the number of pig flights of each type of cleaning pigs must be determined by the amount and type of debris removed. The conclusion of the cleaning process must be when debris recovered is only that from the pigs themselves. This determination will be determined by the project's system supplier and the Contracting Officer), 9) geometry/ultrasonic tool. The pipe wall must be continuously monitored on a real-time basis during the geometry/ultrasonic pig run. Anomalies such as patches, couplings, or flanges must also be identified, and the wall thickness given. The geometry/ultrasonic pig's technician will determine if additional runs are necessary. A permanent data set of internal inspection survey findings must be generated.

3.10.2.2 Preparatory Work

The Government will bring to the attention of the Contractor all statutes, rules and regulations relevant to the performance of the work on the site (on Government property) and will also provide the Contractor with a copy of its own site regulations (if any). Provide the pigging vendors with all-available pipeline records and drawings.

3.10.2.3 Pig Load And Launch

The pig must be loaded into the pig launcher by the Contractor. The method of loading and lodging the front pig cup into the launcher must not involve the use of uncontrolled mechanical force applied to the rear of the pig.

3.10.2.4 Pipeline Operation During Pigging

All pig runs must be made with the line packed with product. The system pumps will be used to propel the pig. The new pig traps will be used for pig launch and retrieval.

3.10.2.5 Brush and Gauging Survey

Run a brush pig at least as often as previously indicated. The brush pig must be designed and provided by the geometry/ultrasonic pig vendor. Additional runs may be required based upon the amount of debris found in the pipeline. The onsite geometry/ultrasonic pig vendor's personnel and COR must determine if additional runs are required. Immediately following the brush pig run and immediately prior to the geometry/ultrasonic survey, run, as a minimum, a single batching pig fitted with a gauge plate equal to 90 percent of the pipeline normal inside diameter. The plate is to be a segmented aluminum disk of 1/8 inch thickness. The plate gauge pig must also include a tracker and tracking equipment. Track the pig assembly above ground during the operation.

3.10.2.6 Geometry/Ultrasonic Survey

After a satisfactory gauging pig run, the pipeline geometric defects must be determined by a geometry/ultrasonic tool. The geometry/ultrasonic tool must provide accurate geometric anomaly detection, and bend radius measuring capability. The data obtained must be presented in a PC software format to allow user friendly analysis and presentation. The geometry/ultrasonic tool assembly must be capable of:

a. Operating in hydrocarbon liquid environment, specifically jet fuel, at a pressure of up to ANSI 300 rating.

b. Traversing the pipeline with nominal wall thickness and possible bore restrictions down to 90 percent of nominal pipe inside diameter.

c. Traversing the pipeline length at a speed of between 3 and 5 ft/sec when propelled by pumped jet fuel. Pressure differential across pig not to exceed 50 psi.

d. Traversing through smooth pipe bends as small as 1.5D (1.5 pipe diameters) radius and single miter bends of up to 10 degrees change of direction.

e. Include a tracker and tracking equipment. Track the pig assembly above ground during the operation. The battery life of the tracker must not be less than 72 hours.

f. Manual loading into the new horizontal pig trap.

The geometry/ultrasonic tool assembly instrumentation performance must be capable of:

a. Battery life to be minimum 18 hours at operating conditions.

b. Principle of operation to be electronically stored geometry system.

c. Geometry sensing to span full circumference and length of pipe, with associated distance measuring method.

d. Geometry system must be capable of:

(1) positive location and identification of each geometric anomaly.

(2) positive location and identification of each bend.

(3) positive location and identification of distance marker reference points of either magnetic or electronic type placed on or above the pipe.

e. Classification of geometric anomalies to be as minimum:

(1) discrimination between ovality and intrusion anomalies.

(2) mechanical damage such as mill defects, dents, internal gouges, and buckles.

(3) pipeline weld defects (such as excess weld penetration).

(4) geometric thickness anomalies. As a minimum, these must be reported in the following categories within the listed accuracy.

(aa) magnitude of anomaly (+/- 1 inch)
(bb) span of anomaly (+/- 1 inch)
(cc) ovality (+/- 0.1 inch)
(dd) span of ovality (+/- 1 inch)
(ee) anomaly station (+/- 1:2,000)

f. Pipe Wall Thickness Survey:

The geometry/ultrasonic tool must provide accurate measurement of pipe wall thickness (+/- 0.01 inch). The data obtained must be presented in a PC software format to allow user friendly analysis and presentation.

3.10.2.7 Lost Pig

The Contractor is responsible for a lost pig, finding the pig, retrieval of the pig, and all repairs, radiographs to the pipeline system and the pig.

-- End of Section --

SECTION 33 52 43.14

AVIATION FUEL CONTROL VALVES
08/18, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.24	(2022) Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A194/A194M	(2022) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A216/A216M	(2021) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A269/A269M	(2015; R 2019) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A320/A320M	(2021a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A352/A352M	(2021) Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service
ASTM A743/A743M	(2021) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM B26/B26M	(2018; E 2018) Standard Specification for Aluminum-Alloy Sand Castings
ASTM D751	(2006; R 2011) Coated Fabrics

ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications

ENERGY INSTITUTE (EI)

EI 1570	(2012) Handbook on Electronic Sensors for the Detection of Particulate Matter and/or Free Water During Aircraft Refueling
EI 1598	(2012) Design Functional Requirements and Laboratory Testing Protocols for Electronic Sensors to Monitor Free Water And/or Particulate Matter in Aviation Fuel

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS 3216	(2005; Rev G) Fluorocarbon (FKM) Rubber High-Temperature - Fluid Resistant Low Compression Set 70 To 80
SAE J200	(2015) Classification System for Rubber Materials
SAE J429	(2014) Mechanical and Material Requirements for Externally Threaded Fasteners

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-8625	(1993; Rev F; Am 1 2003) Anodic Coatings, for Aluminum and Aluminum Alloys

1.2 ADMINISTRATIVE REQUIREMENTS

Design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT. Components must be suitable for ANSI Class 150 (275 psig at 100 degrees F).

a. Control valves specified herein must be of one manufacturer. The valve manufacturer must also produce the hydraulically-operated pilots. For each type control valve required and specified, submit the following:

(1). Flow diagrams.
(2). Operational description of the control valve and pilot control system.
(3). Complete valve assembly list of materials, along with material Certificates of Conformance, used in the manufacture of the

control valves and pilot systems.
(4). sectional drawings of main valve and control pilot systems.

b. Before shipment, each individual control valve must be operationally tested and adjusted by manufacturer under actual flow conditions utilizing a hydrocarbon test fluid with a specific gravity comparable to [Jet A (F-24)][Jet A-1 (F-35)][JP-4 (F-40)][JP-5 (F-44)][JP-8 (F-34)]fuel. Manufacturer must submit certified records of test data.

c. Operation and maintenance information must be submitted for each individual type control valve specified herein. Refer to Section 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Control Valves; G[, [_____]].

SD-03 Product Data

Control Valves; G[, [_____]].

SD-06 Test Reports

Control Valves; .

SD-07 Certificates

Previous Air Force/Military Projects; G[, [_____]].

Qualified Engineers; G[, [_____]].

Field Assistance; G[, [_____]].

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]].

1.4 QUALITY ASSURANCE

1.4.1 Field Assistance

Provide the following:

a. Proof of experience on previous Air Force/Military projects.

b. Number of qualified engineers (factory trained)available to provide startup support.

c. Written assurance as to ability to respond to specified time for field

assistance.

1.4.2 Training

The manufacturer must conduct two eight hour training classes for Liquid Fuels Maintenance Technicians which include valve overhaul procedures, pilot overhaul procedures, valve adjustments, and valve diagnostics. The manufacturer must provide a 4-inch valve mock-up with various trim components (i.e., rate of flow, solenoid control, and speed control features) to be used during training. Video recording of training must be allowed or provided at the time of the class, and an attendance roster maintained by the Contractor. The 4-inch valve mock-up must become the property of the Government and must be turned over to the Contracting Officer. Submit copies of the Operation and Maintenance Manuals for approval.

1.5 WARRANTY

[For this section, Subject Matter Expert (SME) is defined as Service Headquarters Subject Matter Experts. SME for this project is [Air Force - The Air Force Fuels Facilities Subject Matter Expert (HQ AFCEC/COS)[[Army - Headquarters, U.S. Army Corps of Engineers, POL-MCX Facilities Proponent (CECW-EC) through the Army Petroleum Center (APC)] [Navy/Marine Corps - NAVFAC POL Facility Subject Matter Expert (NAVFAC EXWC, CI11)]]].]

If a problem attributable to the valve's manufacturer or installation arises after the initial system start-up has been accomplished, and after system final acceptance date, [48] [_____] hours from the time of notification that a problem exists is allowed to solve the problem. The problem must be solved to the satisfaction of the [Contracting Officer, the Base Civil Engineer and/or the SME] [Contracting Officer]. If the Contractor cannot effectuate a proper resolution to the problem as outlined above in the [48] [_____] hour period, provide a factory trained engineer from the manufacturer of the valve within [48] [_____] hours after the expiration of the Contractor's initial [48] [_____] hour period to effectuate a resolution of the problem above. All services provided by the valve manufacturer must be at no cost to the Government. When it has been determined by the Contractor, Contracting Officer, and the valve manufacturer's representative that the valve(s) cannot be repaired in its installed position in the fuel system, it must be replaced with a new valve and pilot assembly within [48][_____] hours after the initial 96-hour period listed above expires and at no cost to the Government.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

The type of materials which come in contact with the fuel, if not specified herein before, must be noncorrosive.

2.2 CONTROL VALVES

2.2.1 General

Control valves must be single-seated globe type, diaphragm actuated, hydraulically operated valves. Valves must consist of 3 major components: the valve body, valve cover, and diaphragm assembly. The diaphragm assembly must be the only moving part. In the event of diaphragm failure, valve must fail closed against flow, unless otherwise

indicated. The main valve must be drip-tight when closed. Each valve must have an external indicator to show the position of the valve disc at all times. Control valves must be shipped from the factory as a complete assembly with all pilot controls and pilot auxiliary piping properly installed on the main valve. Materials which come in contact with the fuel must be resistant to the effects of and not harmful to aircraft engine fuel and must be stainless steel, or electroless nickel plated cast steel unless noted otherwise. [High level shut-off valve bodies must be electroless nickel plated.] [Valves at exterior locations must be stainless steel. Open canopies are considered an exterior location.] Materials for control valves, and items to be mounted on the valves must be as follows:

2.2.1.1 Bodies, Bonnets, and Covers

Bodies, bonnets, and covers must be constructed of one of the following materials:

a. Cast steel conforming to ASTM A216/A216M, Grade WCB internally plated with chromium, nickel or internally electroless nickel plated.

b. Cast stainless steel conforming to ASTM A743/A743M.

c. Cast steel conforming to ASTM A352/A352M Grade LCB internally plated with chromium, nickel, or internally electroless nickel plated.

d. Bodies must have flanged inlet and outlet connections. Valve must have a screwed bottom drain plug.

2.2.1.2 Valve Seats

Valve seats must be stainless steel in accordance with ASTM A743/A743M. It must be possible to remove the valve seat while the valve is connected in the line. Valve seat and upper stem bearing must be removable and screwed in the body and/or cover. The lower stem bearing must be concentrically contained in the valve seat and must be exposed to flow on all sides. The diameter of the valve seat must be the same size as the inlet and/or outlet flanges of the main valve.

2.2.1.3 Valve Discs

Valve discs must contain a resilient, fluoroelastomer (FKM), commonly referred to as Viton disc conforming to SAE AMS 3216 having a rectangular cross section, contained on 3.5 sides by a disc retainer and a disc guide, forming a drip tight seal against the seat. The disc must be usable on either side. The disc guide must be the contoured type capable of holding disc firmly in place during high differential pressure conditions that may develop across the seating surface. The disc retainer must be capable of withstanding rapid closing shocks.

2.2.1.4 Diaphragm Assembly

Diaphragm Assembly must form a sealed chamber in the upper portion of the valve, separating the operating fluid from the line pressure. The diaphragm assembly must contain a valve stem which is fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. Valve body and cover must be sealed by the diaphragm. Valve stem must be stainless steel. The bearing material must be compatible with the fuel specified and must not contain zinc coated metals, brass, bronze, or

other copper bearing alloys. The diaphragm must be of a nonwicking material or design, with a minimum of 2 layers of nylon fabric bonded with a minimum of 3 layers of synthetic rubber (valves 2-1/2 inches and smaller one layer of nylon fabric). The edge area of the center hole for the valve stem must be sealed by vulcanization. Materials to be resistant to aromatics of up to 50 percent in accordance with ASTM D2000 (SAE J200). The diaphragm must have a MULLINS-burst rating according to ASTM D751 of a minimum of 600 psi per layer of nylon fabric. All diaphragm sizes must be cycle tested to a minimum of 100,000 cycles, by alternately applying pressure under the diaphragm (main valve pressure) and above the diaphragm (cover chamber pressure). That test must be certified by the manufacturer. The diaphragm must not be used as a seating surface. The diaphragm must be fully supported by the body and cover in either the open or closed position.

2.2.1.5 Bolts, Screws and Nuts

a. For Ductile Iron, and Cast Steel Body Valves.

(1) Bolts and Screws, cadmium plated steel in accordance with SAE J429, Grade 5.

(2) Nuts, cadmium plated steel in accordance with ASTM A194/A194M, Grade 2 H.

b. For Stainless Steel Body Valves. Bolts, Screws and Nuts, ASTM A320/A320M, Grade B8M C.1.1.

2.2.1.6 Pilot Control System and Auxiliary Piping

Pilot Control System and auxiliary piping must be stainless steel, seamless, fully annealed tubing conforming to ASTM A269/A269M, Grade TP316, Rockwell hardness B80 or less. Wall thickness for 1/2-inch tubing to be 0.035-inch. Threaded connections must be used in pilot system piping and unions must be o-ring type with FKM o-rings. Tubing connections must not be welded.

2.2.1.7 Pilot Valves

Pilot valves must have [stainless steel bodies conforming to ASTM A743/A743M] [aluminum bodies conforming to ASTM B26/B26M Type 356-T6 anodized in accordance with MIL-A-8625] with stainless steel internal working parts. Disc and diaphragm assemblies must be as specified herein before. The setting of adjustable type pressure operated pilot valves must be easily adjusted by means of a single adjusting screw. The adjusting screw must be protected by a threaded cap drilled to accommodate a lead-seal wire and a lock nut must be provided on the adjusting screw to lock it in position at the desired setting. The lead seal wire must be installed after final acceptance of the system. Spare wire seals and the "embossing" tool will be turned over to the Contracting Officer for the installation.

2.2.1.8 Solenoids

Solenoids for operation of pilot valves must be housed in an explosion-proof case suitable for Class I, Division 1, Group D with maximum temperature rating of T3 (392 degrees F), hazardous locations as defined in NFPA 70. Solenoids must be provided at voltage and frequency as shown on plans. A manual type operator or needle valve to bypass the

solenoid valve must be provided for emergency manual operation.

2.2.2 Serviceability of Main Valve Internal Parts

Main valve movable parts including strainers, valve seat, stem bearings, and control system must be replaceable without removing the main valve from the line. All nonmetallic parts must be replaceable.

2.2.3 Total Lengths

The total valve length does not include the orifice plate flange (when used). If the control valve being supplied has the orifice plate built into its flange, the spacer provided must bring the valve face-to-face dimension equal to those listed below plus 0.0875 inch. The lengths of the valves must be equal for the following materials: cast stainless steel, and cast steel.

SIZE inches	VALVE LENGTH inches
1-1/2	8.5
2	9.375
3	12
4	15
6	20
8	25.4
10	29.8
12	34
14	39
16	41.375
Note: Tolerance must be ±0.03 inch for size 1-1/2 inches through 8 inches and ±0.06 inch for size 10 thru 16 inches.	

Control valves not meeting these face to face dimensions must be supplied with spacers suitable for the proper installation of the valve.

2.2.4 Flanges

MATERIAL	SEALING SURFACE
Cast Steel, ASME B16.5 Class 150	Raised Face
Cast Stainless Steel, ASME B16.5	Raised Face Class 150

MATERIAL	SEALING SURFACE
Ductile Iron, ASME B16.24 Class 150	Flat Face
Note: The mating flange must be made the same as above.	

2.2.5 Identification

2.2.5.1 Main Valve Body

The following must be cast into the main valve body:

a. Pressure Class
b. Size
c. Material
d. Foundry Heat Number and Identification
e. Manufacturer
f. Flow Pattern

2.2.5.2 Main Valve Cover

The following must be cast into the main valve cover:

a. Size
b. Material
c. Foundry Heat Number and Identification

2.2.5.3 Brass Name Plates

Brass name plates must be fastened to the valve. Body name plates must list the following:

a. Size
b. Model Number
c. Stock Number
d. Manufacturer/Supplier
e. Manufacturer's Inspection Stamp

2.2.5.4 Inlet Name Plate

Inlet name plate must list the following:

a. Size
b. "Inlet" Marking
c. Assembly Model Number
d. Part Number

2.2.5.5 Outlet Name Plate

Outlet name plate must list the "Outlet" Marking.

2.2.5.6 Pilot Valves

Pilot valves must be tag identified. The valve must have the field adjusted start up setting engraved on a plastic tag, white with black lettering.

2.3 INDIVIDUAL CONTROL VALVE OPERATIONAL REQUIREMENTS

Operation, performance, and special features of the individual control valves must be as specified herein.

2.3.1 High Liquid Level Shut-Off Valve (HLV-1 AND HLV-2)

2.3.1.1 Size

8-inch

2.3.1.2 Flow

1200 GPM

2.3.1.3 Operation

High liquid level shut-off valve must be hydraulically operated and must be provided with a tank exterior mounted float. Activation point of the float for opening and closing the high liquid level shut-off valve must be as shown on the drawings. Upon a rise in fluid level to the float activation point, the float control system must cause the main valve to close tightly. The main valve must remain closed until a drop in tank fluid level occurs. Upon a drop in fluid level beneath the float activation point, the float control must cause the main valve to open completely.

2.3.1.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.1.5 Manual Test Feature

Manual testing of high level shut-off valve and exterior mounted float's automatic opening and closing feature must be possible.

2.3.1.6 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.1.7 Pressure Sensitive Close Feature

If the upstream pressure rises to 150 psi [____] or above while closing, the valve will stop closing or open slightly until the pressure is less than 150 psi [____].

[2.3.1.8 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 5 to 25 psi.

][2.3.1.9 Opening and Closing Feature

The valve must be equipped with an adjustable differential pressure pilot and a quick cover exhaust system to allow the valve to open in 3-4 seconds when pressure is greater than [____][30] psig.

][2.3.1.10 Solenoid Control

The valve must be provided with solenoid control. The solenoid must close the HLV upon high-high level alarm activation. The solenoid must be energized to close. .

]2.3.2 Non-Surge Check Valve (CV-1 THRU CV-7)

2.3.2.1 Size

6-inch; 2-inch for FTP-1 and Jockey Pump

2.3.2.2 Flow

[950][650]GPM; 50 GPM for FTP-1; 5 GPM for Jockey Pump.

2.3.2.3 Operation

Non-surge check valve must open slowly. Opening speed must be adjustable from two (2) to 30 seconds without affecting closing of valve. Factory set for 15 seconds. The nonsurge check valves must fail closed against reverse flow in check condition.

2.3.2.4 Quick closure

Valve closure to be rapid, closing quickly when outlet pressure exceeds inlet pressure.

2.3.2.5 Flow Control

Valve to limit flow to [950] [650] GPM (CV-1 thru CV-5), 50 GPM (CV-6 and CV-7). Sensing must be by orifice. Valve to modulate to limit flow without hunting. Rate of flow to be manually adjustable and utilize a downstream orifice plate holder.

2.3.2.6 Strainer

A 40-mesh, stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.2.7 Emergency Shut-off Operation

Open/closed valve, solenoid operated (CV-1 thru CV-5). Closure must be accomplished within 10 seconds upon power failure or activation of an emergency-stop pushbutton.

2.3.3 Non-Surge Check/Air Block Valve (AB/CV-1 THRU AB/CV-[ ])

2.3.3.1 Size

4 inch and 2 inch

2.3.3.2 Flow

0-[310][610]GPM and 150 gpm for 2 inch.

2.3.3.3 Operation

Backpressure control pilots will cause main valve to modulate to maintain

constant inlet pressure. There must be 3 backpressure control pilots, A, B, and C. Pilot A must be solenoid enabled and set at pressure which corresponds with unloading pump flow rate of 600 GPM. Pilot B must be solenoid enabled and set at pressure which corresponds with unloading pump flow rate of 300 GPM. Pilot C must be set at pressure corresponding with unloading pump flow rate of 150 GPM through the secondary control valve. All pilots are to have 20-200 PSIG range.

2.3.3.4 Speed Control

Valve must open slowly. Opening speed must be adjustable from two (2) to 30 seconds without affecting closing of valve. Factory set for 15 seconds. The valves must fail closed against reverse flow in check condition.

2.3.3.5 Check Feature

Valve closure to be rapid, closing quickly when outlet pressure exceeds inlet pressure.

2.3.3.6 Solenoid Control

Solenoid control of valve must be as indicated on the drawings.

2.3.3.7 Strainer

A 40-mesh, stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.4 Filter Separator Control Valve (FSCV-1 Thru FSCV-7)

2.3.4.1 Size

6-inch

2.3.4.2 Flow

[900] [600] GPM

2.3.4.3 Operation

Filter Separator Control Valve must limit flow to [900] [600] GPM. Controlling to be by orifice. Rate of flow to be manually adjustable and utilize a downstream orifice plate holder.

2.3.4.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.4.5 Water Slug Shut-Off

Valve must close rapidly when water is sensed at filter separator sump high level as indicated by Float Control Valve float position. Manual testing of operation must be possible.

[2.3.4.6 Shut-Off Feature at Maximum Differential Pressure

Valve must close rapidly when differential control pilot increases to preset point. Resetting of the differential control pilot must be

manually reset after each shutoff.

]2.3.4.7 Emergency Shut-off Operation

Open/closed valve, solenoid operated. Closure must be accomplished within 10 seconds upon power failure or activation of an emergency-stop pushbutton.

2.3.4.8 Solenoid Control

Solenoid control must be as indicated on the drawings.

2.3.4.9 Minimum Differential Pressure Feature

Valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 5 to 25 psi.

2.3.5 Filter Separator Float Control Valve and Tester (FC-1 THRU FC-7)

2.3.5.1 Operation

Float must ride on the fuel-water interface inside filter separator sump. Activation must initiate water slug shutoff of filter separator valve.

2.3.5.2 Float Control Pilot and Tester

The filter separator housing sump must be fitted with a float control pilot valve assembly made of stainless steel. The pilot valve is connected to the filter separator control valve. An integral float control tester must provide a means to remove a portion of the float ball ballast allowing the float to rise, verifying operation of the water slug and flow control valve, and the integrity of the float ball.

2.3.6 Back Pressure Control Valve (BPCV-1)

2.3.6.1 Size

6-inch

2.3.6.2 Flow

0-[2400][2700] GPM

2.3.6.3 Operation

Back pressure control valve must modulate to maintain constant inlet pressure. Set-point must be adjustable with a range of 20 to 200 psig. Factory set at [130] [80] [_____] psig, and 160 psig. Valve must fail in the open position.

2.3.6.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.6.5 Solenoid Control

The valve must be provided with 2 solenoid controls and must operate as indicated on the drawings.

2.3.6.6 Speed Control

Valve must close slowly without affecting the opening speed and must be factory set for 8 seconds. Closing time must be adjustable with a range of 2 to 30 seconds. Valve opening time must be 1.0 second maximum.

[2.3.6.7 Opening Feature

The valve must be equipped with cover quick exhaust system to allow the valve to open in 3-4 seconds when pressure is greater than [_____] [170] psig.

]2.3.7 Pressure Control Valve (PCV-1)

2.3.7.1 Size

2-inch.

2.3.7.2 Flow

50 GPM under normal operating conditions.

2.3.7.3 Operation

Pressure control valve must modulate to control inlet pressure and must have adjustable set-point with a range[s] of 20 to 200 psig. Factory set at 75 psig[, and 50 psig].

2.3.7.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.7.5 Solenoid Control

The valve must be provided with 2 solenoid controls and must operate as indicated on drawings.

2.3.7.6 Speed Control

Provide separate opening and closing speed controls each adjustable between 1 and 30 seconds. Factory set at 3 seconds for opening speed and 1 second for closing speed.

2.3.8 Defuel/Flush Valve (D/FV-1)

2.3.8.1 Size

8-inch.

2.3.8.2 Flow

300 to [2400] [2700] GPM.

2.3.8.3 Operation

Valve must modulate to control inlet pressure and must have adjustable set-point with a range of 20 to 200 psig. Factory set at 80 psig.

2.3.8.4 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

2.3.8.5 Solenoid Control

The valve must be provided with 2 solenoid controls and must operate as indicated on drawings.

2.3.8.6 Speed Control

Valve must open slowly without affecting the closing speed and must be factory set for 3 seconds. Opening time to be adjustable with a range of 2 to 30 seconds.

2.3.9 Hydrant Control Valve (HCV)

2.3.9.1 Size

4 inch

2.3.9.2 Flow

600 GPM.

2.3.9.3 Operation

Hydrant control valve must modulate, by use of a liquid sensing line from [pantograph] [refueler] venturi, and regulate at a maximum pressure at the skin of the aircraft of 45 psig at any flow rate from 50 to 600 GPM. Pressure to be adjustable with a range of 15 to 75 psi. Valve, adapter and 90-degree hydrant coupler pressure drop must not exceed 9 psi at 600 GPM with the valve fully open.

2.3.9.4 Quick Closure

Valve must close rapidly when outlet pressure exceeds control set-point. Valve must limit the surge pressure on the aircraft to a maximum of 120 psig when fueling at 600 GPM with an aircraft tank valve closure of 0.5 second. The valve must reopen when the outlet pressure drops below the set-point of the pilot if the deadman control lever is still depressed.

2.3.9.5 Deadman Control

Deadman must be [hydraulically] [pneumatically] connected to the pilot system of main valve. Valve must open when deadman control lever is pressed and must close valve when the lever is released to bleed air from the hydrant hose truck. On rupture of the deadman hose between outlet of deadman control and main valve pilot system, there must be no fuel leakage. Main valve must close in 5 seconds maximum when deadman is released or when one of the deadman hose couplers is disconnected.

2.3.9.6 Defuel

Valve must be capable of reverse flow at the rate of 300 GPM at 165 psig. Valve must be capable of defueling regardless of nozzle pressure created by the R-12.

'

2.3.9.7 Speed Control

Valve must open slowly without affecting the closure rate. Provide adjustable speed control with a range of 2 to 30 seconds.

2.3.9.8 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

2.3.9.9 Adapter

Valves must be provided with type adapter as indicated on drawings. Adapter must have pressure equalizing feature and have a vacuum tight dust cap.

2.3.9.10 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

[2.3.9.11 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 5 psi to 25 psi.

][2.3.9.12 Contaminant Analyzer

The contaminant analyzer must use laser sensing technology to detect contaminants in the fuel. The complete contaminant analyzer component (including valve) must be in compliance with EI 1570 and EI 1598.

A. Sensor

1. Sensor must sense the presence of free water and solid particles entrained in fuel by sensing a change in electrical properties or light scatter patterns. No chemical means must be allowed. No use of consumables must be allowed.

2. Sensor must be capable of quantifying the concentration of contamination with the fuel. Contamination is defined as solid particles and undissolved or free water.

3. Sensor must differentiate between free water and solids. Sensor must quantify amount of each type of contamination within the fuel supply.

a. Sensor must be able to detect a high water "slug" defined as a free water measurement between 0 and 20 parts per million (ppm) (volume/volume) and have an accuracy of +/- 2 ppm or less; +/- 10% error or less. Factory set at 10 ppm.

b. Sensor must be able to provide solids measurement between 0.0 and 2.0 milligrams per liter, mg/L (ppm weight/volume is also acceptable), and have an accuracy of +/- 10% error or less. Factory setting based on end customer established issue requirements. Unless otherwise specified by customer, for US Army, 1.0 mg/L, for US Navy, 2.0 mg/L, and for US Air Force, 0.5 mg/L.

c. Sensor must be able to sense free water and solids independently and simultaneously to the accuracy stated in a and b.

4. Sensor must be able to start automatically on the initiation of fueling and once the fueling is over sensor must automatically shut off.

5. Sensor must sense high water "slug" and give an alarm output within 3 seconds of the event.

6. Sensor must recover from 50% water slug event within 30 minutes of clean fuel flow and 5 minutes for a high water "slug". Sensor must be able to recover automatically. Removal from piping must not be allowed. Fuel is defined as clean fuel when the water and solid measurements are below the thresholds listed in A.3.a an A.3.b

7. Calibration report must be included with sensor and must include detailed calibration method description.

B. Mechanical/Design

1. Sensor must use the full flow of product; i.e. sensor must be full flow, no sample lines must be allowed.

2. Sensor must be able to operate on rated flow of the system, and provide less than 5 psi loss of pressure at rated flow.

3. Valve and sensor must have a design pressure of 275 psi (gauge) or higher, an operation pressure of -1.5 psi to 200 psi pressure and a proof (test) pressure in excess of 415 psi.

4. Power to the system must be in the form of Alternating Current (AC). AC voltage requirements: 110-240 VAC, 50/60Hz; 40 Watt maximum power draw.

a. Sensor must be designed for and constructed to standards for operation in hazardous locations, minimum of Class 1, Division 2, per NFPA 497.

C. Output

1. Sensor must output a digital data stream that can be imported to a data acquisition system. Analog signals must not be allowed.

2. Sensor must be able to send data signals over long distances (greater than 50 feet,) which may be accomplished by data signal conversion.

D. Controls

1. A three position switch with the following functions must be provided: Bypass, Alarm, Alarm and Closure.

2. Bypass position must allow the alarm and closure to be deactivated and continue with fueling, completely disregarding the quality alerts being given.

a. In the event that the alarm system is bypassed, fuel quality information must continue to be collected. The bypass of the sensor may not be by powering down, or turning off the sensor.

3. Alarm position must sound an alarm and illuminate a red light upon detection of contamination.

4. Alarm and Closure position must perform the alarm functions and close the valve upon detection of contamination.

5. Alarm thresholds must be field adjustable.

6. Alarm system must be set up in a ‘Fail Safe’ manner so that in the event of

a. Incorrect or impaired functioning of the equipment, caused by reduction in supply voltage, or by any other means, the equipment must go into alarm and provide an alert to its condition

b. Loss of power, the equipment must go into closure position and when the power is restored, the equipment must go into the alarm condition.

7. A green light must be illuminated when the system is on and operational.

E. Valve Configuration

1. Sensors meeting the above requirements must be configured as a part of the control valve.

2. Sensing must be initiated by the opening of the control valve.

3. Sensor power down sequence must be initiated by closure of control valve.

4. Sensor must be capable of affecting the alarm shutdown condition directly on the control valve, stopping flow of fuel at the sensing location.

a. Sensor must retain ability to have an alarm override, and allow normal function of the control valve in event the sensor is impaired.

F. Modular User Readout - Sensor must interface to a modular user readout with the following features:

1. User readout consisting of a backlit LCD display indicating free water content in PPM and particulate solids in mg/L.

2. A visual alarm indicator lamp viewable from 50 feet.

3. A key operated by-pass switch.

4. Data logging feature to capture historical data on a flash memory card.

5. A real-time RS-232 data port for connection to a laptop

computer equipped with compatible software.

6. A real time PC-based graphical user interface for data capture and viewing.

]2.3.10 Overfill Valve for Product Recovery Tank (OV-1)

2.3.10.1 Size

2-inch.

2.3.10.2 Capacity

50 GPM.

2.3.10.3 Operation

Hydraulically operated overfill valve must close automatically upon rising to Product Recovery Tank 95 percent fill level. Valve must open automatically upon falling below level as indicated on the drawings.

2.3.10.4 Control Float

Automatic opening and closing of the valve must be initiated by a control float located within the Product Recovery Tank. Control float must be provided with a manual tester, mounted external to the tank, for testing of overfill valve operation.

2.3.10.5 Pressure Reservoir

Valve must be provided with a pressure reservoir to supply required hydraulic pressure for operation. Reservoir pressure to be supplied by Fuel Transfer Pump (FTP-1)using 0.5-inch tubing connected upstream of the pump non-surge check valve. Valve must close upon loss of reservoir pressure. Reservoir must be a 1 gal capacity bladder-type tank, carbon steel constructed, tested and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi and precharged with air of 13-15 psig. The tank will be epoxy lined. The tank will be fitted with an air charging valve and pressure gauge.

2.3.10.6 Thermal Relief

Overfill valve must be provided with a pressure sustaining control valve that must automatically, upon inlet pressure rising to 200 psig, open allowing thermal relief around overfill valve. Pressure sustaining valve must automatically close upon inlet pressure dropping below 200 psig.

2.3.10.7 Limit Switch

Limit switch must be single pole, single throw contract (SPST) and provided with valve for remote indication of valve open or closed position. Valve closed position will become an alarm condition at the pump control panel (PCP).

2.3.10.8 Strainer

Pressure reservoir inlet line must be provided with a shut-off valve, strainer and check valve.

2.3.11 Truck Fill Stand Control Valve (TFV)

2.3.11.1 Size

4-inch.

2.3.11.2 Flow

525 GPM.

2.3.11.3 Operation

Valve must modulate to regulate downstream pressure to 35 psig at a flow rate of 50 to 525 GPM. Pressure must be adjustable with a range of 15 TO 75 psi. Valve solenoid must be connected to the overfill protection system.

2.3.11.4 Quick Closure

Valve must close rapidly when outlet pressure exceeds control set-point. Valve must limit the surge pressure on the bottom loader of a tank truck to a maximum of 85 psig when filling at 600 GPM with a tank truck valve closure of 0.5 second. The valve must reopen when the outlet pressure drops below the set-point of the pilot if the deadman control lever is still depressed.

2.3.11.5 Opening Speed Control

Valve must control the opening speed of the main valve. The control must be adjustable with a range of 2 to 30 seconds. Factory set at 10 seconds.

2.3.11.6 Deadman Control

Deadman must be hydraulically [electronically (Navy Ships)] connected to the pilot system of the main valve. Valve must open when deadman control lever is pressed and must close the valve when the lever is released. On rupture of the deadman hose between outlet of deadman control and main valve pilot system, there must be no fuel leakage. Main valve must close in 2 seconds maximum when one of the deadman hose couplers is disconnected. Length of hose must be 15 feet.

2.3.11.7 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

2.3.11.8 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

2.3.11.9 Solenoid Control

Solenoid control of valve must operate as indicated on drawings.

2.3.12 Pantograph Control Valve (PTCV)

2.3.12.1 Size

4-inch.

2.3.12.2 Flow

600 GPM.

2.3.12.3 Operation

Valve must modulate, by use of a liquid sensing line from the pantograph venturi, and regulate downstream to 55 psig at a flow rate of 50 to 600 GPM. Pressure must be adjustable with a range of 15 to 75 psi.

2.3.12.4 Opening Speed Control

Valve must control the opening speed of the main valve. The control must be adjustable with a range of 2 to 30 seconds. Factory set at 10 seconds.

[2.3.12.5 Thermal Relief

Valve to open for pressure equalization and return flow when downstream pressure exceeds upstream pressure.

][2.3.12.6 Strainer

A 40-mesh stainless steel wire, self-cleaning strainer must be provided in the pilot valve supply piping.

]2.3.12.7 Minimum Differential Pressure Feature

The valve must be equipped with a minimum differential pressure pilot to maintain a differential pressure across the valve. Pressure must be adjustable with a range of 5 to 25 psi.

2.3.13 Flushing Valve (FV-1)

2.3.13.1 Size

6-inch.

2.3.13.2 Flow

0-1200 GPM.

2.3.13.3 Operation

Valve must open and close by means of hydraulic line pressure.

2.3.13.4 Solenoid Control

Solenoid control of valve must operate as indicated on drawings.

2.3.14 Pantograph Pressure Control Valve (PPCV-1 thru PPCV-[ ])

2.3.14.1 Size

1-1/2-inch.

2.3.14.2 Operation

Valve must open and close by means of hydraulic line pressure. Initial setting must be 75 PSIG and must be field adjustable between 50-100 PSIG. Final field pressure setting of valve must be equal to 10 percent above recorded line pressure at 600 GPM flow rate.

2.3.14.3 Check Valve Feature

Valve must close rapidly when outlet pressure exceeds inlet pressure.

PART 3 EXECUTION

3.1 VALVE TESTING AND START-UP SUPPORT

Provide the services of a factory trained and certified service engineer authorized/sanctioned/certified by the valve manufacturer to verify that each valve has been properly installed and to verify valves were factory operationally tested, adjusted and set per these specifications. The service engineer must assist the Contractor in the valve start-up adjustment process and will remain on site until all control valves function as required by the contract documents.

-- End of Section --

SECTION 33 52 43.23

AVIATION FUEL PUMPS
08/18, CHG 1: 02/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 7	(1995; Stabilized (S) 2013) Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plan

AMERICAN PETROLEUM INSTITUTE (API)

API STD 610	(2010; Errata 2011) Centrifugal Pumps for Petroleum, Petrochemical, and Natural Gas Industries
API STD 682	(2014) Pumps Shaft Sealing Systems For Centrifugal and Rotary Pumps

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A182/A182M	(2021) Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A487/A487M	(2021) Standard Specification for Steel Castings Suitable for Pressure Service
ASTM A582/A582M	(2021) Standard Specification for Free-Machining Stainless Steel Bars
ASTM A743/A743M	(2021) Standard Specification for

	Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM C827/C827M	(2016) Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures

HYDRAULIC INSTITUTE (HI)

HI M100	(2009) HI Pump Standards Set

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 112	(2017) Standard Test Procedure for Polyphase Induction Motors and Generators

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; ERTA 20-3 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4; TIA 20-5; TIA 20-6; TIA 20-7; TIA 20-8; TIA 20-9; TIA 20-10; TIA 20-11; TIA 20-12; TIA 20-13; TIA 20-14; TIA 20-15; TIA 20-16; ERTA 20-4 2022) National Electrical Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC SP 10/NACE No. 2	(2015) Near-White Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D; Notice 1 2021) Paint, Epoxy-Polyamide, General Specification for
MIL-PRF-4556	(1998; Rev F; Am 1 1999; CANC Notice 1 2011) Coating Kit, Epoxy, for Interior of Steel Fuel Tanks

1.2 ADMINISTRATIVE REQUIREMENTS

Design conditions must be as specified in Section 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT.

a. Tests: Hydrostatic, performance, vibration, and NPSH tests must be conducted at the factory on each pump in accord with API 610. Test each pump with the actual motor which will drive the pump in the field, unless the water test media will cause overload of the motor. If so, provide vibration test report for motor separately. Vertical

turbine pump vibration test must be run with field driver. All tests will be observed by the Contracting Officer or the designated representative. Provide the Contracting Officer 30 [_____] days notice prior to performance of factory tests in order to schedule observing such tests. Remote access via web cam must be made available. Performance testing must not occur prior to acceptance of shop drawing submittal.

b. Test reports must bear the serial number of both pump and driver. Submit manufacturer's certified reports of hydrostatic, performance, and NPSH tests. Submit manufacturer's certified test curves..

c. Operation and Maintenance Manuals must be submitted for the pumps and appurtenance specified herein. Refer to Section 01 78 23.33OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS for the information to be submitted.

d. Motors, manual or automatic motor control equipment, except where installed in motor control centers, and protective or signal devices required for the operation specified herein must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Any wiring required for the operation specified herein, but not shown on the electrical plans, must be provided under this section in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Motors must be high efficiency type and in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fueling Pumps (FP-1 through FP-5); G[, [_____]].

Offload Pumps; G[, [_____]].

Fuel Transfer Pump; G[, [_____]].

Water Draw-Off Pump; G[, [_____]].

SD-03 Product Data

Fueling Pumps (FP-1 through FP-5); G[, [_____]].

Offload Pumps; G[, [_____]].

Fuel Transfer Pump; G[, [_____]].

Water Draw-off Pump; G[, [_____]].

SD-06 Test Reports

Certified Test Curves

SD-07 Certificates

Fueling Pumps (FP-1 through FP-5); G[, [_____]].

Offload Pumps; G[, [_____]].

Fuel Transfer Pump; G[, [_____]].

Water Draw-off Pump; G[, [_____]].

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]].

PART 2 PRODUCTS

2.1 FUELING PUMPS (FP-1 through FP-5)

2.1.1 Capacity

Capacity must be 600 gpm against a total head of [_____] feet when driven at 3600 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum of [_____] percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump shut-off head must have a 10 to 20 percent head rise to shut off. Pump must be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pumps must not overheat or be damaged in any way while operating continuously at a minimum flow condition of 150 gpm and continuously at a maximum flow condition of 125 percent required capacity. The unit will also be required to operate at a flow of 12.5 percent required capacity GPM without exceeding the vibration limits given in API STD 610 at that flow rate. These pumps are for parallel operation and must have equal head at minimum continuous stable flow, plus or minus 2 percent.

2.1.2 General Requirements

a. The pumps must meet the requirements of API STD 610, latest edition. Whenever the information contained herein conflicts with said standard, the information herein must govern. The pumps must run at a nominal 3600 rpm and must be single stage centrifugals, horizontally mounted, vertical or radial split case, enclosed impeller, with end suction and top vertical discharge. Pumps must be of the back pull-out design to permit removing case half from rear for access to internal parts without disturbing the suction or discharge piping or the driver. All parts must be factory inspected so that parts are interchangeable. Pumps and motors must be furnished as complete units as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from minimum flow to 120 percent of design flow.

b. The pump must require no more than 18-feet of net positive suction head (NPSHR) when it is operated with water at a capacity of 600 gpm at rated head and speed. A hydrocarbon reduction or correction factor must not be used. Pump suction specific speed must be less than 12,000.

c. The pump must be horizontal, single stage, single suction with double

volute construction to assure radial balance. It must be designed to permit removal of the impeller, shaft, bearings and bearing housing as an assembly, without disconnecting the suction or discharge piping.

d. The pump case must be end suction, centerline discharge type for ease of piping alignment. Flange ratings must be class 300-pound per ASME B16.5. The case must be designed for maximum discharge pressure at pumping temperature but not less than 550 psig, with a minimum corrosion allowance of 1/8-inch. The suction and discharge flanges as well as the cover bolting surfaces must be backfaced or spotfaced for positive bolt seating. The radial case to cover split must be a metal-to-metal fit with a confined, controlled compression gasket.

e. The pump cover must contain a stuffing box designed to accept an unbalanced mechanical seal. The stuffing box must have a minimum of 3-inch studs for seal gland bolting. The gasket fit for seal gland to stuffing box must be of the controlled compression type with metal-to-metal joint contact.

f. Both case and cover are to be fitted with renewable wear rings.

g. The impeller must be of the enclosed type, dynamically and hydraulically balanced. It must be key driven, held in place by a positive lock, threaded against rotation. The running clearance between the impeller and case-cover wear rings must be as required by API STD 610.

h. Mechanical Seal: A single unbalanced mechanical seal per API STD 610 code USTHN, unbalanced single seal with throttle bushing seal gland, a nitrile seal-ring-to-sleeve gasket and carbon against silicon carbide faces, of multiple spring design must be supplied. The seal gland must be tapped for three connections and each must be stamped for identification as follows: Q for quench; F for flush; and D for drain. A non-sparking throttle bushing pressed into the seal end plate against an outside shoulder must be provided to minimize leakage on complete seal failure.

i. Bearing Housing: Oil lubricated anti-friction, radial and thrust bearings of standard design must be supplied. The bearings must be selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Bearings must be retained on the shaft and fitted into housings in accordance with ABMA 7. Locking of the ball thrust bearing to the shaft must be by series W tank type washer. Minimum spacing between bearing centerlines must be 6.5-inches.

j. A sight glass for checking oil level with a permanent indication of proper oil level must be supplied.

k. Bearing housings must be equipped with labyrinth type end seals and deflectors where the shaft passes through the housing; lip-type seals must not be used. Deflectors must be made of non-sparking material. The deflector design must effectively retain oil in the housing and prevent entry of foreign material into the housing.

l. Shafts must be of ample size to transmit the maximum torque required under specified operating conditions, and to withstand continuously all stresses resulting from supported weights, thrusts and starting, including across-the-line motor starting. It must be key seated to provide positive drive for the coupling, shaft sleeve and impeller.

The shaft stiffness factor must be under[70 for Type III][88 for Cut and Cover]. The radial bearing centerline to impeller centerline, distance and the pump shaft diameter under the sleeve must be provided to calculate the factor.

m. A spacer coupling must be supplied. The spacer length must permit the removal of the assembled pullout element without disturbing the driver or the suction and discharge piping. Couplings must be properly keyed in place. Cylindrical fits must be light enough to permit easy removal of the hub in the field without the need for heating. A service factor of at least 1.5 must be used in selecting couplings based on manufacturer's ratings.

n. Removable coupling guards of the non-sparking type must be supplied. They must comply with the requirements of OSHA.

o. Total indicated shaft runout at coupling end must be 0.001-inches or less. Total shaft deflection must be no more than 0.002-inches at face of stuffing box.

p. Baseplate: The baseplate must be of fabricated steel construction. It must be of the drain pan style, sloping from back to front. Connections for a drain must be tapped (1-inch minimum) at the pump end and located to accomplish complete drainage. A sufficient number of grout holes of at least 5-inches minimum diameter must be supplied and must have 1/2-inch minimum raised lip edge. Pump pedestals must be trapezoidal in design.

q. Materials: No zinc, brass, bronze or other copper bearing alloy must come in contact with the fuel. Materials must be material class C-6, unless otherwise noted.

r. The case and cover must be constructed of stainless steel ASTM A487/A487M GR CF8M or ASTM A487/A487M GR CA6NM.

s. Impeller material must be stainless steel ASTM A487/A487M GR CF8M or ASTM A743/A743M CA 6NM or CA 15.

t. Wear rings must be stainless steel ASTM A182/A182M GR F6 or ASTM A276/A276M TP410 or 416.

u. Shaft must be stainless steel ASTM A276/A276M type 410 or 416 or ASTM A582/A582M Type 410 or 416 or ASTM A743/A743M CA15 HT-403.

v. Testing: All shop testing must be performed in accordance with the API STD 610.

2.1.3 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, attached by stainless steel pins at an accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, gpm
Pumping head, ft.
Maximum specific gravity of fluid to be pumped

Revolutions per minute
Horsepower of driver

2.1.4 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 1/4-inch high must bear the equipment number as shown on the drawings.

2.1.5 Exterior Primer Coat

Exterior surfaces of the baseplate must be primed by the manufacturer. Coating must be applied meeting requirements of SSPC PA 1. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441, Type 1, Class 3. Dry film thickness must be 2 to 4 mils.

2.1.6 Exterior Topcoat

Manufacturer's standard exterior topcoat must be applied at factory to the base plate.

2.1.7 Motors

a. Motor must be furnished by the pump manufacturer and must be non-overloading with 10 percent head increase, and suitable for the environment and operating conditions to which it will be subjected. The motors unity service factor may be used to conform to the non-overloading through-out the curve requirement for the 10% head increase condition only. Select the lowest horsepower for the motors that will meet the non-overloading requirement and co-ordinate the MCC if different than shown. Motors for vertical turbine pumps must be provided with anti-reversing ratchet. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor must be UL listed for use in Class 1, Division 1, Group D hazardous areas, and must have a maximum temperature rating of T2D (419 degrees F) as defined by NFPA 70. The motor nameplate must include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating must be 460 volts, 3 phase, 60HZ. Motor nominal speed must match pump. Motors must be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10 percent above or below rated voltage.

c. Pump manufacturer must assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve. In addition to having sufficient horsepower-output rating at rated speed, motor must have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of 10 starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors

with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors must conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are subject to variation, service factors above unity must not be applied in sizing motor.

d. Motor must be squirrel-cage induction type. Motor must be NEMA Design B (normal-torque, low starting current).

e. Motor insulation must be non-hydroscopic, NEMA Class H, 82 degrees F for motors over 10 hp and NEMA Class F, 302 degrees F for 10 hp and smaller. Stator windings must be epoxy impregnated. The impregnations must be applied by the vacuum and pressure process.

f. Winding temperature rise, (based on a maximum ambient temperature of 104 degrees F at 3300-feet altitude) must not exceed 176 degrees F.

g. Bearings must be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures must be totally enclosed, weather sealed, fan cooled, explosion-proof and must be listed and labeled for Class 1, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections must be terminated within a single terminal housing.

i. The dynamic balance, overspeed withstand capability, and sound power levels of the motor must conform with NEMA standard requirements.

j. The pump manufacturer must furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor must be provided with temperature limiting thermostats within the motor frame when required to meet Class 1, Group D requirements.

l. Pump motor must be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower must be the premium efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies must be (based on 3600, 2 pole, totally enclosed):

20 hp	92.0 percent	75 hp	95.5 percent
25 hp	92.0 percent	100 hp	93.5 percent
30 hp	92.0 percent	125 hp	94.5 percent
40 hp	92.0 percent	150 hp	94.5 percent

50 hp	92.5 percent	200 hp	94.5 percent
60 hp	92.5 percent	600 hp	94.5 percent

n. Other motors of different speed or housing classification must also be of the premium efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor efficiencies must have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in IEEE 112, Method B. All shop drawing submittals on motor driven equipment must include the motor efficiency.

2.2 FUELING PUMP (VERTICAL TURBINE) (FP)

2.2.1 Capacity

Capacity must be [600][900] gpm against a total head of [_____] feet for the Fueling Pump, when driven at 1800 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum [_____] percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump must be capable of at least 5 percent head increase at rated conditions by installing a new impeller.

2.2.2 Assembly

The pump for this service must meet the requirements of API STD 610, latest edition, seventh edition for vibration. Wherever the information contained herein conflicts with said standard, the information herein must govern. The pump for this service must run at a nominal 1800 rpm and must be a multi-stage, vertical turbine pump. Pump and motor must be furnished as a complete unit as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from minimum flow to 120 percent of design flow. Flanged column, shaft, and bearing spacing must not exceed 5-foot sections to facilitate pump disassembly within pump room.

2.2.3 Materials

The materials of construction for the pump shaft and the impeller must be stainless steel. All other materials must be material class S-1 with the wetted ferrous parts such as the bowl interiors enamel-lined, bowl exteriors, column interior and exterior, discharge head interior epoxy-coated per MIL-PRF-4556, and discharge head exterior epoxy-coated per MIL-DTL-24441.

2.2.3.1 Mechanical Seal

API STD 682, balanced type, API Class Code BSTHN.

2.2.4 Construction

Castings used for any part of pumps must be sound and free of shrink or blow holes, scale, blisters, and other similar casting defects. The surfaces of casting must be cleaned by sand or shot blasting, pickling, or other standard methods used by the manufacturer. All mold parting fins and remains of gates and risers must be either chipped, filed, or ground flush with the surface of the casting. The repair of casting leaks and defects by peening or by the use of cement compounds is prohibited. All

welding to be per ASME BPVC SEC IX.

2.2.4.1 Couplings

Couplings must be flanged, rigid spacer type, CPAT or equal. The couplings must be of the spacer-type with a spacer of sufficient length to permit replacement of the mechanical seal assembly without removing the motor. The pump half coupling must be of such design that it can be removed without the use of heat. Coupling halves must fit tightly to the shafts of the pump and the driver so as not to become loose during operation. The coupling must be provided with an OSHA approved coupling guard.

2.2.4.2 Impeller

Impeller must be enclosed and double keyed to the shaft for radial loads and fixed in the axial position by shaft sleeve nuts, or other positive positioning device. Impellers must be held to the shaft so that the impeller will not become loose should the pump accidentally rotate in reverse direction. The impeller must be statically and dynamically balanced to 8 W/N.

2.2.4.3 Wear Rings

Renewable stainless steel wearing rings must be positively locked on the impeller. Wearing rings must fit with close tolerances so as to permit a minimum of recirculation. Wear ring hardened surfaces differential must be at least Brinell 50. Positive locking case wearing rings must be provided so that the case wearing rings will not rotate or change position in the case. Clearances must be established for hydrocarbon (Jet Fuel) service.

2.2.4.4 Shaft

Shaft must be designed with a high safety factor to easily withstand the torsional loads and other stresses to which it may be subjected. It must be so designed that there will be no detrimental vibration stresses. Surfaces must be ground to accurate dimensions. Shaft deflection must be limited to 0.0020-inch maximum when measured at the face of the mechanical seal under the operating condition of zero flow at shut off head. Seal piping from the discharge to the mechanical seal must be provided. The pump shaft must be in maximum 5 foot sections, and couplings must be keyed and split ring type, not threaded.

2.2.4.5 Finishing

Passageways and impellers must be finished to permit maximum efficiency and provide noise reduction. Overall sound levels must not exceed OSHA limits.

2.2.4.6 Bearings

Bearings must be product-lubricated. Sleeve type, carbon graphite must be provided. Bearing spacing must be per API STD 610, eight edition, but must not exceed 5-foot in any case.

2.2.4.7 Drilling and Tapping

Casting must be drilled and tapped for drain and seal recirculation

lines. All connections must be provided with plugs.

2.2.4.8 Mounting Flange

Mounting flange must be coordinated with the tank's mounting flange, and must be ANSI or API pattern, and contain a 1-inch tapping for air eliminator discharge.

2.2.4.9 Pump Discharge

Pump discharge head must include a 1 inch tapping at the highest point with valve, 100 mesh strainer, and air eliminator valve, as specified in Section 33 52 43.13, AVIATION FUEL PIPING, with check valve on outlet.

2.2.4.10 Special Tools

Pumps must be furnished with special tools necessary to dismantle and reassemble the unit.

2.2.4.11 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, securely attached by stainless steel pins at an easily accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, gpm
Pumping head, ft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.2.4.12 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 1/4-inch high must be the equipment number as shown on the drawings.

2.2.4.13 Primer Coat

Surfaces of the pump and baseplate must be primed by the manufacturer. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441 Type 1, Class 3. Dry film thickness must be 2 to 4 mils.

2.2.4.14 Topcoat

Topcoat must be factory applied and must be white and conforming to specification MIL-DTL-24441.

2.2.5 Motor

a. Motor must be furnished by the pump manufacturer and must be suitable for the environment and operating conditions to which it will be subjected and be provided with anti-reversing ratchet. The motors unity service factor may be used to conform to the non-overloading

through-out the curve requirement for the 10% head increase condition only. Select the lowest horsepower for the motors that will meet the non-overloading requirement and co-ordinate the MCC if different than shown. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor must be UL listed for use in Class 1, Division 1, Group D hazardous areas, and must have a maximum temperature rating of "T2D 419 degrees F " as defined by NFPA 70. The motor nameplate must include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating must be 460 volts, 3 phase, 60HZ. Motor nominal speed must match pump. Motors must be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10 percent above or below rated voltage.

c. Pump manufacturer must assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve based on the future potential of a 5 percent head increase. In addition to having sufficient horsepower-output rating at rated speed, motor must have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of 10 starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors must conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are subject to variation, service factors above unity must not be applied in sizing motor.

d. Motor must be squirrel-cage induction type, high thrust vertical P base, unless bearing frame pump is utilized. Motor must be NEMA Design B (normal-torque, low starting current).

e. Motor insulation must be non-hydroscopic, NEMA Class F, 302 degrees F for motors. Motor windings must be supplied with extra dips and bakes.

f. Winding temperature rise, (based on a maximum ambient temperature of 104 degrees F at 3300-feet altitude) must not exceed 176 degrees F.

g. Bearings must be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures must be totally enclosed, weather sealed, fan cooled, explosion-proof and must be listed and labeled for Class 1, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections must be terminated within a single terminal housing.

i. The motors must be dynamically balanced and vibration measured per NEMA MG 1, vibration and balance under category "precision". Motor

overspeed withstand capability and sound power levels of the motor must conform with NEMA standard requirements.

j. The pump manufacturer must furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor must be provided with temperature limiting thermostats within the motor frame when required to meet Class 1, Group D requirements.

l. Pump motor must be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower must be the premium efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies must be (based on 1800 rpm, 4 pole, totally enclosed):

20 hp	92.0 percent	75 hp	95.5 percent
25 hp	92.0 percent	100 hp	93.5 percent
30 hp	92.0 percent	125 hp	94.5 percent
40 hp	92.0 percent	150 hp	94.5 percent
50 hp	92.5 percent	200 hp	94.5 percent
60 hp	92.5 percent	600 hp	94.5 percent

n. Other motors of different speed or housing classification must also be of the premium efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor efficiencies must have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in IEEE 112, Method B. All shop drawing submittals on motor driven equipment must include the motor efficiency.

2.3 OFFLOAD PUMPS

2.3.1 Capacity

Capacity must be [600] [300] gpm against a total head of [_____] feet when driven at 3600 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum of 60 percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump shut-off head must have a 10 to 20 percent head rise to shut off. Pump must be capable of at least a 10 percent head increase at rated conditions by installing a new impeller. Pumps must not overheat or be damaged in any way while operating continuously at a minimum flow condition of 150 gpm and continuously at a maximum flow condition of 125 percent required capacity GPM. The unit will also be required to operate at a flow of 12.5 percent required capacity without exceeding the vibration limits given in API STD 610. These pumps are for parallel operation and must have equal head at minimum continuous stable

flow, plus or minus 2 percent.

2.3.2 General Requirements

a. The pumps for this service must meet the requirements of API STD 610, latest edition. Whenever the information contained herein conflicts with said standard, the information here in must govern. The pumps for this service must run at a nominal 3600 rpm and must be single stage centrifugals, horizontally mounted, vertical or radial split case, enclosed impeller, vertical-in-line with end suction and discharge. All parts must be factory inspected so that parts are interchangeable. Pumps and motors must be furnished as complete units as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow.

b. The pump must require no more than 15.5-feet of net positive suction head (NPSHR) when it is operated with water at a capacity of [600] [300] gpm at rated head and speed. A hydrocarbon reduction or correction factor must not be used. Pump suction specific speed must be less than 12,000.

c. The pump must be vertical in-line, single stage, single suction with double volute construction to assure radial balance. It must be designed to permit removal of the impeller, shaft, bearings and bearing housing as an assembly, without disconnecting the suction or discharge piping. Pump must be designed to remove the mechanical cartridge seal without removing the motor.

d. The pump case must be vertical in-line type for ease of piping alignment. Flange ratings must be class 300-pound per ASME B16.5. The case must be designed for maximum discharge pressure at pumping temperature but not less than 550 psig, with a minimum corrosion allowance of 1/8-inch. The suction and discharge flanges as well as the cover bolting surfaces must be backfaced or spotfaced for positive bolt seating. The radial case to cover split must be a metal-to-metal fit with a confined, controlled compression gasket.

e. The pump cover must contain a stuffing box designed to accept an unbalanced mechanical seal. The stuffing box must have a minimum of 3-inch studs for seal gland bolting. The gasket fit for seal gland to stuffing box must be of the controlled compression type with metal-to-metal joint contact.

f. Both case and cover are to be fitted with renewable wear rings.

g. The impeller must be of the enclosed type, dynamically and hydraulically balanced. It must be key driven, held in place by a positive lock, threaded against rotation.

h. Mechanical Seal. A single unbalanced mechanical seal per API STD 610 code USTHN of multiple spring design must be supplied. The seal gland must be tapped for three connections and each must be stamped for identification as follows: Q for quench; F for flush; and D for drain. A non-sparking throttle bushing pressed into the seal end plate against an outside shoulder must be provided to minimize leakage on complete seal failure.

i. Bearing Housing. Grease lubricated anti-friction, radial and thrust bearings of standard design must be supplied. The bearings must be

selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Pumps may be provided with or without bearing brackets.

j. Shafts must be of ample size to transmit the maximum torque required under specified operating conditions, and to withstand continuously all stresses resulting from supported weights, thrusts and starting, including across-the-line motor starting. It must be key seated to provide positive drive for the line motor starting. It must be key seated to provide positive drive for the coupling, shaft sleeve and impeller. The shaft stiffness factor must be under 70. The radial bearing centerline to impeller centerline, distance and the pump shaft diameter under the sleeve must be provided to calculate the factor.

k. A rigid type spacer coupling must be supplied. The spacer length must permit the removal of the assembled pullout element without disturbing the driver or the suction and discharge piping. Couplings must be properly keyed in place. Cylindrical fits must be light enough to permit easy removal of the hub in the field without the need for heating. A service factor of at least 1.5 must be used in selecting couplings based on manufacturer's ratings.

l. Removable coupling guards of the non-sparking type must be supplied. They must comply with the requirements of OSHA.

m. Total indicated shaft runout at coupling end must be 0.001-inches or less. Total shaft deflection must be no more than 0.002-inches at face of stuffing box.

n. Materials. No zinc, brass, bronze or other copper bearing alloy must come in contact with the fuel.

o. The case and cover must be constructed of stainless steel ASTM A487/A487M GR CF8M or ASTM A487/A487M GR CA6NM

p. Impeller material must be stainless steel ASTM A487/A487M GR CF8M or ASTM A743/A743M CA 6NM.

q. Wear rings must be stainless steel ASTM A182/A182M GR F6 or ASTM A276/A276M TP410 or 416 or ASTM A743/A743M CA15 HT-403.

r. Shaft must be stainless steel ASTM A276/A276M type 410 or 416 or ASTM A582/A582M Type 410 or 416 with renewable shaft sleeve of ASTM A276/A276M type 316L with hard facing under mechanical seal gasket.

s. Testing. All shop testing must be performed in accordance with the HI M100.

2.3.3 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, attached by stainless steel pins at an accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, gpm

Pumping head, ft.
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.3.4 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 1/4-inch high must bear the equipment number as shown on the drawings.

2.3.5 Exterior Primer Coat

Exterior surfaces of the baseplate must be primed by the manufacturer. Coating must be applied meeting requirements of SSPC PA 1. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441, Type 1, Class 3. Dry film thickness must be 2 to 4 mils.

2.3.6 Exterior Topcoat

Manufacturer's standard exterior topcoat must be applied at factory to the base plate.

2.3.7 Motors

a. Motor must be furnished by the pump manufacturer and must be suitable for the environment and operating conditions to which it will be subjected. Provide space heaters suitable for operation on 460 or 120 volts as indicated on the drawings within the motor enclosure to prevent moisture condensation after shut-down. Motor must be UL listed for use in Class 1, Division 1, Group D hazardous areas, and must have a maximum temperature rating of T2D (419 degrees F) as defined by NFPA 70. The motor nameplate must include the temperature rating of the motor and locked-rotor indicating code letters in accordance with NFPA 70, Table 430-7(b).

b. Voltage rating must be 460 volts, 3 phase, 60HZ. Motor nominal speed must match pump. Motors must be capable of delivering rated horsepower output successfully and continuously under conditions of voltage variations of 10 percent above or below rated voltage.

c. Pump manufacturer must assure the specified output and proper operation of the pump without being overloaded at unity service factor when operating at any point on the pump performance curve. In addition to having sufficient horsepower-output rating at rated speed, motor must have performance characteristics which will allow, without injurious overheating of the motor, accelerating the load from standstill to rated speed under conditions of 10 starts per hour. Attention is specifically directed to the fact that thermal characteristics of motors with regard to capability for accelerating the load may vary greatly from motor manufacturer to motor manufacturer, notwithstanding that the horsepower rating may be the same. It is the pump manufacturer's responsibility to provide motors with adequate thermal starting characteristics as well as adequate rated-speed operating characteristics. Service factors must conform with NEMA standards; however, service factors are only applicable at rated nameplate voltage and frequency. Since all system voltages are

subject to variation, service factors above unity must not be applied in sizing motor.

d. Motor must be squirrel-cage induction type. Motor must be NEMA Design B (normal-torque, low starting current).

e. Motor insulation must be non-hydroscopic, NEMA Class F, 300 degrees F for motors. Stator windings must be epoxy impregnated. The impregnations must be applied by the vacuum and pressure process.

f. Winding temperature rise, (based on a maximum ambient temperature of 104 degrees F at 3300-feet altitude) must not exceed 176 degrees F.

g. Bearings must be ABMA minimum L10 life of 60,000 hours or L50 life of 300,000 hours suitable for the size, type, and application when the pump is operating at the specified flow and head.

h. Motor enclosures must be totally enclosed, weather sealed, fan cooled, explosion-proof and must be listed and labeled for Class 1, Group D areas. Provide bronze ground bolt on motor enclosure. All motor external electrical connections must be terminated within a single terminal housing.

i. The dynamic balance, overspeed withstand capability, and sound power levels of the motor must conform with NEMA standard requirements.

j. The pump manufacturer must furnish the Contracting Officer with the recommended minimum run time for the motor.

k. Pump motor must be provided with temperature limiting thermostats within the motor frame when required to meet Class 1, Group D requirements.

l. Pump motor must be furnished with lifting lugs on the motor casing.

m. Unless indicated otherwise, motors for conventional applications over 15 horsepower must be the premium efficient type. This requirement is not applicable to hermetically sealed motors, integrally mounted motors, motors specified as part of energy efficient equipment, wound rotor motors, or any application involving special construction or performance. Guaranteed minimum full load efficiencies must be (based on 3600 rpm, 2 pole totally enclosed):

20 hp	92.0 percent	75 hp	95.5 percent
25 hp	92.0 percent	100 hp	93.5 percent
30 hp	92.0 percent	125 hp	94.5 percent
40 hp	92.0 percent	150 hp	94.5 percent
50 hp	92.5 percent	200 hp	94.5 percent
60 hp	92.5 percent	500 hp	94.5 percent

n. Other motors of different speed or housing classification must also be of the premium efficient type, as advertised by the motor manufacturer, with efficiency greater than the standard line. Motor

efficiencies must have been verified in accordance with NEMA MG 1, 12.53.a., and determined using the dynamometer method as described in IEEE 112, Method B. All shop drawing submittals on motor driven equipment must include the motor efficiency.

2.4 FUEL TRANSFER PUMP (FTP-1) AND WATER DRAW-OFF PUMP (WSP-1 AND WSP-2)

2.4.1 Capacity

Capacity must be 50 gpm against a total head of [_____] feet for the Fuel Transfer Pump, and 50 gpm against a total head of [_____] feet for the Water Draw-off Pump, when driven at 1800 rpm. Overall efficiency at design conditions of pump and driver, connected, must be minimum [_____] percent. Pump head capacity must be continually rising and must be free of dips and valleys from design point to shut-off head. Pump must be capable of at least 10 percent head increase at rated conditions by installing a new impeller.

2.4.2 Assembly

The pump for this service must meet the requirements of API STD 610, latest edition, seventh edition for vibration. Wherever the information contained herein conflicts with said standard, the information herein must govern. The pump for this service must run at a nominal 1800 rpm and must be a [single stage] [multi-stage], vertical turbine pump. Pump and motor must be furnished as a complete unit as herein specified. Pump assembly must be statically and dynamically balanced for all flow rates from minimum flow to 120 percent of design flow.

2.4.3 Materials

The materials of construction for the pump shaft and the impeller must be stainless steel. All other materials must be material class S-1 with the wetted ferrous parts such as the bowl interiors enamel-lined, bowl exteriors, column interior and exterior, discharge head interior epoxy-coated per MIL-PRF-4556, and discharge head exterior epoxy-coated per MIL-DTL-24441.

2.4.3.1 Mechanical Seal

API STD 682, balanced type, API Class Code BSTHN.

2.4.4 Construction

Castings used for any part of pumps must be sound and free of shrink or blow holes, scale, blisters, and other similar casting defects. The surfaces of casting must be cleaned by sand or shot blasting, pickling, or other standard methods used by the manufacturer. All mold parting fins and remains of gates and risers must be either chipped, filed, or ground flush with the surface of the casting. The repair of casting leaks and defects by peening or by the use of cement compounds is prohibited.by ASME BPVC SEC VIII D1.

2.4.4.1 Couplings

Couplings must be flanged, rigid spacer type, CPAT or equal. The couplings must be of the spacer-type with a spacer of sufficient length to permit replacement of the mechanical seal assembly without removing the motor. The pump half coupling must be of such design that it can be

removed without the use of heat. Coupling halves must fit tightly to the shafts of the pump and the driver so as not to become loose during operation. The coupling must be provided with an OSHA approved coupling guard.

2.4.4.2 Impeller

Impeller must be keyed to the shaft for radial loads and fixed in the axial position by shaft sleeve nuts, or other positive positioning device. Impellers must be held to the shaft so that the impeller will not become loose should the pump accidentally rotate in reverse direction. The impeller must be statically and dynamically balanced.

2.4.4.3 Wear Rings

Renewable wearing rings must be positively locked on the impeller. Wearing rings must fit with close tolerances so as to permit a minimum of recirculation. Positive locking case wearing rings must be provided so that the case wearing rings will not rotate or change position in the case.

2.4.4.4 Shaft

Shaft must be designed with a high safety factor to easily withstand the torsional loads and other stresses to which it may be subjected. It must be so designed that there will be no detrimental vibration stresses. Surfaces must be ground to accurate dimensions. Shaft deflection must be limited to 0.0020-inch maximum when measured at the face of the mechanical seal under the operating condition of zero flow at shut off head. Shaft must be protected through the mechanical seal by means of a shaft sleeve. Seal piping from the discharge to the mechanical seal must be provided.

2.4.4.5 Finishing

Passageways and impellers must be finished to permit maximum efficiency and provide noise reduction. Overall sound levels must not exceed OSHA limits.

2.4.4.6 Bearings

Bearings must be product-lubricated. Sleeve type, carbon graphite must be provided. Bearing spacing must be per API STD 610.

2.4.4.7 Drilling and Tapping

Casting must be drilled and tapped for drain and seal recirculation lines. All connections must be provided with plugs.

2.4.4.8 Mounting Flange

Mounting flange must be coordinated with the tank's mounting flange, and must be ANSI or API pattern.

2.4.4.9 Special Tools

Pumps must be furnished with special tools necessary to dismantle and reassemble the unit.

2.4.4.10 Service Nameplate

A pump service nameplate, of type 18-8 stainless steel or monel, securely attached by stainless steel pins at an easily accessible point on the pump, must be furnished in addition to the identification nameplate. The pump service nameplate must be stamped with the following information:

Manufacturer's name
Serial number of pump
Capacity, gpm
Pumping head, ft
Maximum specific gravity of fluid to be pumped
Revolutions per minute
Horsepower of driver

2.4.4.11 Identification Nameplate

A pump identification nameplate of Type 18-8 stainless steel or monel must be provided and securely attached by stainless steel pins to a conspicuous place on the pump head. Tagging in letters 1/4-inch high must be the equipment number as shown on the drawings.

2.4.4.12 Exterior Primer Coat

Exterior surfaces of the pump and baseplate must be primed by the manufacturer. Surface cleaning must meet requirements of SSPC SP 10/NACE No. 2. Metal primer must be zinc rich paint conforming to specification MIL-DTL-24441 Type 1, Class 3. Dry film thickness must be 2 to 4 mils.

2.4.4.13 Exterior Topcoat

Manufacturer's standard exterior topcoat must be factory applied and must be white.

2.4.5 Motor

Refer to paragraph, Motors for the Fueling Pumps.

PART 3 EXECUTION

3.1 PREPARATION FOR SHIPMENT

3.1.1 Rust Preventative

Exterior machine surfaces must be coated with a rust preventative. Pumps must be disassembled after the shop running tests and inspected, and internal parts must be coated with a rust preventative before reassembling.

3.1.2 Closure of Openings

Threaded openings must be provided with metallic plugs or caps. Flanges must be gasketed with rubber and closed with 3/16-inch thick plate of the same outside diameter as the match flange. A minimum of four full-diameter bolts must hold closure in place.

3.1.3 Assembly

Pumps must be shipped assembled or a field service engineer must be

furnished to supervise the field assembly at no additional cost to the Government.

3.1.4 Bracing

Each unit must be suitably prepared for shipment, supported and braced, with auxiliary equipment secured to prevent damage during shipment.

3.1.5 Vapor Inhibiting Wraps

Exposed shafts and shaft couplings must be wrapped with waterproof moldable waxed cloth or vapor inhibitor paper. The seams must be sealed with adhesive tape.

3.1.6 Shipping Identification

Each pump must be identified with a metal tag showing the item number. Material shipped separately must be marked with a metal tag indicating the item number for which it is intended.

3.2 INSTALLATION

Install equipment and components true to line, level and plumb, and measured from established benchmarks or reference points. Follow manufacturer's recommended practices for equipment installation. Provide required clearances between equipment components. Equipment, apparatus, and accessories requiring normal servicing or maintenance must be easily accessible.

3.2.1 Anchoring

Anchor equipment in place as indicated on the drawings or per manufacturer's recommendations. Minimum anchor bolt size is 5 inch. Check alignment of anchor bolts and/or bolt holes before installing equipment and clean-out associated sleeves. Do not cut bolts due to misalignment. Notify the Contracting Officer of errors and obtain the Contracting Officer's acceptance before proceeding with corrections. Cut anchor bolts of excess length to the appropriate length without damage to threads.

3.2.2 Grouting

Equipment which is anchored to a pad must be grouted in place. Before setting equipment in place and before placing grout, clean surfaces to be in contact with grout, including fasteners and sleeves. Remove standing water, debris, oil, rust, coatings and other materials which impair bond. Clean contaminated concrete by grinding. Clean metal surfaces of mill scale and rust by hand or power tool methods. Provide formwork for placing and retaining grout. Grout to be non-metallic, non-shrink, fluid precision grout of a hydraulic cementitious system with graded and processed silica aggregate, portland cement, shrinkage compensating agents, plasticizing and water reducing agents; free of aluminum powder agents, oxidizing agents and inorganic accelerators, including chlorides; proportioned, pre-mixed and packaged at factory with only the addition of water required at the project site. Grouting to meet requirements of ASTM C827/C827M. Perform all grouting in accord with equipment manufacturer's and grout manufacturer's published specifications and recommendations.

3.2.3 Leveling and Aligning

Level and align equipment in accord with respective manufacturer's published data. Do not use anchor bolt, jack-nuts or wedges to support, level or align equipment. Install only flat shims for leveling equipment. Place shims to fully support equipment. Wedging is not permitted. Shims to be fabricated flat carbon steel units of surface configuration and area not less than equipment bearing surface. Shims to provide for full equipment support. Shim to have smooth surfaces and edges, free from burrs and slivers. Flame or electrode cut edges not acceptable.

3.2.4 Direct Drives

Alignment procedure follows.

3.2.4.1 Rotation Direction and Speed

Check and correct drive shaft rotation direction and speed.

3.2.4.2 End Play

Run drive shafts at operational speed. Determine whether axial end play exists. Run drive shaft at operational speed and mark drive shaft axial position when end play exists. Block drive shaft in operating position when aligning drive shaft with driven shaft.

3.2.4.3 Shaft Leveling and Radial Alignment

Check shaft leveling by placing a straightedge across the two coupling half faces in both horizontal and vertical planes.

3.2.4.4 Angular Alignment and End Clearance

Pump alignment must be accomplished by the factory technician or a millwright trained in pump alignment, and with the use of dial gauges or laser alignment equipment.

3.2.4.5 Final Recheck

Check adjustments with dial indicator after completing recheck. Align shafts within 0.002-inch tolerance, except as otherwise required by more stringent requirements of equipment manufacturer.

3.2.5 Start-up Representative

A manufacturer's field service representative must be provided at no additional cost to the Government to check the pumps for proper operation prior to start-up and also to witness, as a minimum, the first two days of operation. Any additional time required due to delays or corrections must be provided at no additional cost to the Government. The manufacturer's field service representative must also instruct the required personnel in the proper operation and maintenance of the pumps.

-- End of Section --